

MOTOR AGE

Vol. XXIX
No. 13

CHICAGO, MARCH 30, 1916

Ten cents a copy
Three dollars a year



JOHNSON'S PREPARED WAX

For Polishing the Finest Cars

It preserves the varnish and protects it from the weather, adding years to its life. It prevents checking, sheds water and makes a "wash" last twice as long. Johnson's Prepared Wax is a paste. It imparts a polish so hard, dry and glasslike that it cannot gather dust.

JOHNSON'S CLEANER

contains no acid or grit of any kind—it cannot injure or scratch the finest finish. It will entirely remove all stains, discolorations, scum, road oil, tar and grease from your car. Even those spots that are ground in—mud freckles—and surface scratches which you thought were permanent—will disappear like magic under Johnson's Cleaner.

USE COUPON AND CONVINCE YOURSELF

S. C. JOHNSON & SON, Racine, Wis. MA 32

I enclose 10c for a trial can each of Johnson's Cleaner and Prepared Wax—sufficient for a good test.

Name

Address

City and State.....



First Choice of over 300,000 Owners

who bought them during the last few months. The profits on the sale of Stewart Warning Signals in your town are yours—if you go after them. The new prices have caused a second stampede. It is easier to sell a Stewart Signal than to try and push unknown makes.

***Stewart* Warning Signal**
MOTOR-DRIVEN

Stewart-Warner Speedometer Corporation, Chicago, U. S. A.



Published by the
CLASS JOURNAL COMPANY
910 South Michigan Avenue
CHICAGO ILLINOIS

NEW YORK OFFICE, 239 West 39th Street

Entered as Second-Class Matter September 19, 1899, at the Postoffice at Chicago, Illinois, Under Act of March 3, 1879—Member of the Audit Bureau of Circulations. Circulation Audited and Verified December 8, 1914—Copyright by the Class Journal Co., 1916. Published every Thursday.

United States, Mexico and U. S. Possessions.....One year \$3.00
Canada.....One year \$5.00; All Other Countries in Postal Union....One year 6.00

BEWARE OF SUBSCRIPTION SOLICITORS OFFERING PREMIUMS OR CUT RATES—ALL CURRENCY SHOULD BE SENT BY REGISTERED MAIL.

SUBSCRIPTIONS received up to the 15th of the month begin with first issue of that month; those received later, start with first issue of following month.

RENEWALS or CHANGE OF ADDRESS should be sent two weeks in advance of date they are to go into effect. Be sure to send old as well as new address to avoid unnecessary delay. RECEIPT of first copy is acknowledgment of subscription.

Volume XXIX

March 30, 1916

No. 13

Contents

PREPAREDNESS FOR SPRING MOTORING.....	5
Putting your car in trim for the touring season	
MOTOR CARS FIGURE STRONGLY IN MEXICAN CAMPAIGN.....	10
Busy scenes are a part of the every-day life of Columbus, N. M.	
PACKARDS OFF FOR MEXICO.....	15
All time records broken in shipment of twenty-seven machines	
EDITORIAL—ECONOMY TESTS—SHORTER SPEEDWAY RACES....	16
IS LOW-GRADE FUEL CAUSE OF OVERHEATING?.....	17
Present grades of gasoline blamed for lubricating troubles	
ARGO MOTOR CO. SOLD.....	18
FEDERAL AID FOR ROADS IN 43 STATES.....	19
Bankhead bill gives impetus to movement	
MORTALITY OF WAR CARS FOUND LOWER THAN AT START.....	20
Highly organized traveling repair shops	
REO ENGINEER PREDICTS NORMAL GASOLINE PRICES AFTER WAR	24
Horace T. Thomas disputes those who foresee a climbing market	
FORD TO MAKE GASOLINE BY RITTMAN PROCESS?.....	25
Government officials depart for Detroit to assist with plan	
MATERIALS SCARCE AND PRICES HIGH.....	26
Contracts of motor car manufacturers date 18 months ahead	
S. A. E. STANDARDS IN TRACTOR ENGINES.....	27
N. G. E. A. favors adopting specifications of motor car engineers	
GRAND PRIX DELAGES TO AMERICA FOR CAMPAIGN.....	28
Strong competitor in season's events—Harry Harkness, importer	
BURMAN WINS SAN DIEGO EXPOSITION CUP.....	29
Tetzlaff second in first boulevard event held at fair grounds	
PACKARDS NOT IN RACING GAME.....	30
Exhibition speedwork at factory grounds	
FOREIGN CARS FOR AMERICAN RACES.....	31
Europe's speed masters turn attention to United States	
WALTHAM DEVELOPS NEW SPEEDOMETER.....	36
WHAT THE INSURANCE POLICY ON YOUR CAR MEANS TO YOU... 38	
Why you are obliged to pay more for protection than others	
MOTOR CAR DEVELOPMENT.....	44
Ziola magneto, Mack truck radiator, Milburn electric described	

DEPARTMENTS

See America First.....	17	Among the Makers and Dealers.	48
Motor Car Repair Shop.....	34	Recent Incorporations.....	49
Readers' Clearing House.....	40	Accessory Corner.....	50
From the Four Winds.....	46	Index to Advertisements.....	126

—NEXT WEEK—

A feature article of Motor Age for April 6 will be the first installment of a series on Tires—Their Care and Repair. The series is intended primarily for the car owner and will tell him how he can increase the mileage of his tires—Also the latest reports of military motors on the Mexican border and the European trenches from our special war correspondents at the front.

1899

1916

Growth

Twice in the short lapse of five years, MOTOR AGE has outgrown its quarters.

Doubling and trebling in circulation—doubling and trebling in influence—doubling and trebling in working force, today it ranks the largest weekly motor car publication in the world.

In its new home in the Mallers Building—centrally located and within a block of the busiest corner in Chicago—with greatly increased office facilities and with an organization working at splendid efficiency, MOTOR AGE enters upon its sixteenth year, now more than ever to be reckoned with as one of the most powerful and productive factors in motor car affairs.

MOTOR AGE

AFTER APRIL 1 MALLERS BLDG.

S. E. Cor. Wabash Ave. and
Madison St., Chicago, Ill.

TELEPHONE: RANDOLPH 6960



The New Home of MOTOR AGE

and the Western Offices of
THE CLASS JOURNAL CO.
and its allied interests

THE AUTOMOBILE "MOTOR PRINT
MOTOR WORLD" COMMERCIAL VEHICLE
THE AUTOMOBILE BLUE BOOKS
THE AUTOMOBILE TRADE DIRECTORY

Larger Quarters
Central Location
Increased Facilities
Top (21st) Floor

MALLERS BUILDING—CHICAGO
S. E. Corner Wabash Ave. and Madison St.



Why we are Studebaker Dealers

As far back as ten years ago, I saw immense possibilities in the automobile industry. At that time cars were handled, as a rule, by mechanics, and by a few others merely as a "side line."

Three years later, in 1909, when the four-cylinder car became practical and popular, I looked over the field for a good line to handle—a line manufactured by a company in which the public had confidence; and it was only natural that I should try to get the Studebaker agency, as this Company had a reputation and had a popular car. So, after some negotiations, my partner and I secured this agency, and we have found it to be the best possible connection.

From time to time, when the demand was greater than the supply of Studebakers, we added to our line other well-known makes, only to drop them when the harsh school of experience flatly showed us our blunder. For the past two years we have handled Studebakers exclusively, and we expect to continue this plan.

We now KNOW that the Studebaker is the best value, and that the Studebaker Company "backs up" its product as no other company does. That is why we are Studebaker dealers.

W. S. BENSON,
Anderson & Benson
Austin, Texas

Such pages torn from the Book of Experience go farther towards illustrating the fallacy of a dealer's seeking to handle two lines of cars and the success that any dealer can be sure of with Studebaker alone, than any other evidence we know. It is the experience of

hundreds of men who once were dealers for several makes of cars and now are achieving larger successes than ever before with this one Studebaker line of dominant VALUES. Write for information on the cars and the opportunities open.

STUDEBAKER

South Bend, Ind.

Detroit, Mich.

Walkerville, Ont.

Address all correspondence to Detroit

When Writing to Advertisers, Please Mention Motor Age

MOTOR AGE

Preparedness for Spring Motoring

By Leslie V. Spencer

the fast train would not be able to maintain its schedule if it were not made ready at the terminal before the start each day. The motor car cannot be expected to run satisfactorily on those early spring trips into the country that you are planning, unless you get it ready.

All winter long you have either left it standing in the garage to await the call of the spring, or you have driven it about the city streets in the snow and water and ice. It has gotten out of the habit of making long trips; its joints have a sort of stiff feeling. It needs overhauling before you use it very strenuously. You know how it feels to sit still for a long time. Your knees get stiff; you have to move around to get "limbered up." The car that has been in winter storage or light city use during the cold months may be likened to the man who has been in the habit of taking very little exercise. The first few times he goes on a long walk his legs ache, and he has to go through a process of preparation for such more strenuous exercise.

Why Overhauling Is Necessary

It is just as bad for the car to drive it long distances after its period of lethargy without first overhauling it—giving it its spring rejuvenation—as it would be for anyone who had not been training for such a strain to go on a long cross-country run. No real athletic trainer would allow a green man to do it. He would first put the prospective athlete through a long period of training before permitting violent exercise.

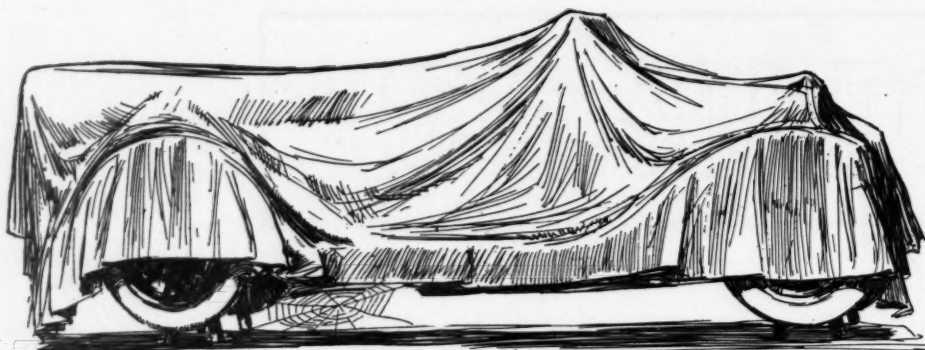
We motorists, you see, have our own kind of preparedness just as the other fellows. Our kind means a thorough overhauling of every part of the mechanism and a renewing of worn parts so as to put the machine in condition for long trips

PREPAREDNESS is a word that has gained a reputation for itself within the last few months. It is on the lips of the President of the United States; Congressional leaders harangue about it; newspapers and magazines comment upon it; William Jennings Bryan and Henry Ford frown upon it. Nevertheless, events in the great world war have shown the advantage of being prepared, and the lessons to be learned from the conflict apply not only to armies and navies, but to all other activities as well. We must be prepared for whatever we are going to do, whether it be for defending our country, for selling goods, or for running our motor cars.

The army that has the greatest amount of equipment in readiness and the most men prepared for instant duty is likely to be the one to have the advantage. The navy whose ships are in best condition and are stocked with ammunition for immediate service is very apt to prove successful over an adversary not so well prepared. The great passenger locomotive that pulls



J. M. WILDER



All winter long you have left it standing in the garage. It has gotten out of the habit of making long trips

again. We cannot expect to get the service we want unless we do this, and we have no one to blame but ourselves if we punish our cars when they are not in condition. Many a blow-out or more serious breakdown results from a long grind in the country with the first few warm breaths of spring air before the car has been made ready for the year's real touring work.

After having been confined to the city streets all winter it is indeed a temptation to take a long drive in the country as soon as the roads and the temperature will permit, but remember that there will be still other and warmer days and get the car in shape now before these real days are upon us. A few dollars now and some of your time will be a good investment and may save you many dollars in repair bills later on.

Overhauling the car does not mean a superficial inspection of the chassis and body, and the tightening of a few noticeably loose nuts and bolts. It means a thorough and systematic job of putting the whole vehicle in the best possible condition. It is somewhat of an undertaking and may take you a week, perhaps, unless you put all of your time on it and rush the work through. Put on a pair of overalls and a jacket, don an old hat and attack the proposition in earnest. It will pay in the end.

Best Take Inventory First

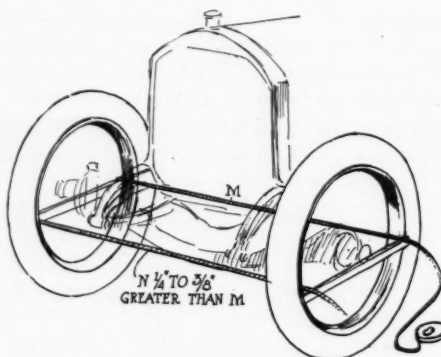
First, before getting seriously mixed up with the oil pan, the steering gear or the axles, take inventory and make sure you have all the tools and supplies you will reasonably need for the job. Do your running around in the car before you get it dismantled. Check up your tool kit and see that you have wrenches, screwdrivers and other apparatus that your experience has taught you to look for when doing any work around the car. A good, strong jack, some heavy blocks of wood that will serve to hold up one side of the car solidly or a low saw-horse are essentials. See to it that you have a supply of nuts and bolts of sizes that might be needed; get some lock washers, some cotter pins of assorted sizes, and be sure to have enough grease and lubricating oil to replace all of the old oil that you are going to drain out of motor and other parts. If the wiring is to be renewed, buy the wire now before

starting in on the work. If you know you are going to reline the brakes, now is the time to buy the new material. Possibly some new gaskets are going to be needed before the job is done. Nothing is more discouraging than to get nicely started on a thing and then to find that you must stop for want of necessary supplies. It wastes time, too.

Find Worst Faults

Pay first attention to those things that are most the matter with the car. You know from driving it through the winter what faults there are, and the best way is to attack those first. If the motor has a knock, then start with that unit and determine if it is a bearing or a piston or some other condition that has been responsible for the trouble. If you know that the brakes are in bad shape and have not been holding as they should, then proceed to fix them first. Possibly the wheels are out of line. If this is the most serious trouble, true them up first before doing the general inspection work. These are the things that will take the most time, and it is better to get the big undertakings out of the way first while you are most enthusiastic over the thing. Later your ardor may slacken a little, but by that time the worst will be over. It is purely a matter of psychology in this respect.

If the car is not possessed of any chronic ailments, then the place to begin in the systematic overhauling is the engine. Drain all the water from the cooling system, shut off the gasoline and then remove the oil from the crankcase. Don't try to save this old oil because it is very apt to be dirty and to contain a certain amount



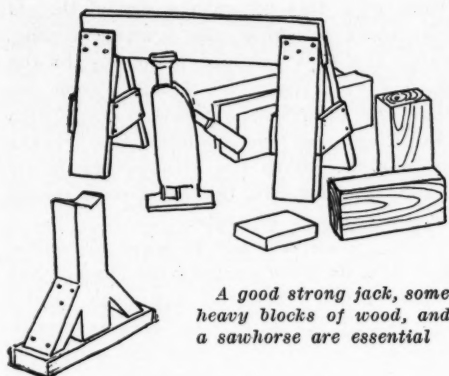
Truing up the wheels, giving them the proper camber and gather

of foreign matter. In putting everything in the pink of condition the motor deserves new oil. Then thoroughly clean the whole power plant. Wipe off the accumulated grease and dirt, using gasoline to assist in the removal of the oily matter. You will be surprised how much more hopeful the whole thing will seem after it has been brightened up a bit, especially as you will do considerable rubbing around the engine before you have finished. Take off the mud pan and clean it out, and then you are ready to remove the bottom of the crankcase so as to get at the interior of the motor and the bearings. Wipe the crankcase and oil pan clean and dry of all oil and go over the whole interior so far as possible with the idea of ridding it of any gummy oil that may have collected. A fine spray of gasoline or a gasoline-soaked sponge is admirable for this purpose.

Inspect the bearings carefully and if there has been enough wear to make it necessary to take them up, the rather intricate work should be undertaken if you have sufficient confidence in your ability to do it correctly. This is one thing that must be done absolutely correctly, and unless you are sure of yourself better call in a repair man for the time being. It should not be necessary to scrape the bushings unless they are scored or unduly worn due to insufficient oiling. In most engines shims are provided between the caps and the part of the bearings that are in the crankcase or in the rod itself, as the case may be. These are usually of several thicknesses, so that the desired number or size can be taken out to absorb the wear. Be sure to remove exactly the same thickness from both sides of the bearing and then put the cap back in place, tighten the bolts to the required degree of snugness and examine the assembly. If there is still play, or if the cap seems to fit too tightly remove or put in sufficient to make sure of the adjustment. You will have to spend considerable time over this part of the work providing there is trouble in the bearings. It would be very foolish to touch them at all if the engine runs properly and there is no looseness.

Crank Engine by Hand

Having taken care of the bearings to the best of your ability try cranking the engine by hand. If you can rock the shaft back and forth with reasonable effort all well and good, but if it seems too stiff you probably have the bearings too tight. There is a happy medium between the two extremes. Sometimes you can tell the condition of a bearing by tapping the cap lightly with a hammer. A hollow sound would indicate that it is too loose. Examine the pistons and upper ends of the rods as best you can from underneath and see if all seems true within the cylinders. Loose and broken rings, loose pistons and worn wrist-pin bearings ought to come to light in this inspection, and if there are any of these ailments the best thing to do is to tear the cylinders down. It is not



A good strong jack, some heavy blocks of wood, and a sawhorse are essential

advisable for the owner to do this intricate work himself unless he has the equipment. It is to be hoped that you will find everything as it should be in this connection and that you can proceed.

Symptoms of Carbon

Some motors that have been working with a great deal of sluggishness, missing occasionally and heating up unduly are suffering from carbon, and no spring overhauling would be complete without an attack upon this nuisance. It is to be hoped that your engine is of the detachable head variety so that access to the combustion chambers and valves will be a simple matter. Otherwise you will have to scrape the incrustations out as best you can with some of the scraping tools that any supply store should carry. The oxy-acetylene flame method of burning it out is good too and if this apparatus is available it will save you a great deal of trouble. If you have a removal head motor, take the top plate or plates off by all means and thoroughly scrape all the carbon off of the cylinder walls, valve pockets and cylinder heads. If the engine is not of this type, and unless the carbon is very bad indeed, it should be possible for you to use some of the flexible scrapers without taking the cylinder blocks from the crankcase. That is a mean job, for you have to fit the cylinders back over the pistons and rings and such a procedure has tried the patience and temper of many a man. Remove the valve caps and bring each piston in turn up flush with the port, after which a scraper that looks like a small hoe can be used advantageously to scrape off that which has collected on the piston top, bringing it out through the valve opening. Soak a piece of cloth in kerosene oil and work it around within the combustion space to clean out the small particles. Other forms of flexible sharp-edged tools can be inserted and manipulated so as to scrape practically all the walls and pockets.

Next the valves should be ground. Nearly any engine that has been in service for a number of months will be the better for valve grinding, and while it is a somewhat tiresome job, it must be done. Some kind of a valve tool is needed to raise the spring so that the little piece of steel that holds the lower spring seat in place can be removed, thus letting the spring down and permitting the valve to be pulled upward. Inspect the valve seat and the edge

of the valve itself and determine the condition. Badly pitted valves might better be replaced than used again, but you can tell this by looking them over. But whether you use new valves or the same ones, they must be ground to their seats. A good valve-grinding compound should then be thinly spread on the seat and the edge of the valve, and the forward and back turning begun. Stuff a piece of waste or cloth in the valve opening so that the compound will not get into the cylinder. A grinding tool that imparts the grinding motion is very handy, but lacking this you can do the work by hand by using a screw-driver or brace with a screw-driver bit. Get a smooth and shiny seat and valve edge before going to the next one because this valve business is one of the things that gives the engine power. Be sure to put the right valve back in the right pocket, for although they all look alike each is intended for its own designated place, and is usually numbered to correspond with the cylinder.

Examine the valves carefully for bent or warped stems, and if you find any that are in this condition it would be well to replace them. Worn stems are also a common trouble, and they being somewhat smaller than the guides they work in, they are apt to be noisy. New valves do not cost a great deal, and the added satisfaction they give the owner and the greater power they mean to the engine offsets the outlay.

It is foolish to get them, however, unless the old ones are in very bad shape. Be careful also to put the right spring back on each valve. Exhaust springs are often of different tension than inlets, and it is hard to tell them apart so they must not be mixed. Next adjust the valves so that there will be just enough clearance between the stems and the tappets to draw out a piece of heavy paper without tearing.

The carbon entirely removed, the valves ground and the springs back in position you are now ready to put the cylinder head back in place or to replace the valve

plugs if the head is integral. Be careful not to damage the head gasket that goes between the casting and the head, for if you do there is apt to be leakage of compression. Do not tighten the head bolts down in a haphazard manner either. You might crack the casting if you did, for the object is to equalize the strain as the bolts are drawn down one by one. First tighten the center ones; then proceed to fasten the outside ones alternately going from one side to the other. In this way the head will not be distorted and there will be no tendency for leakage.

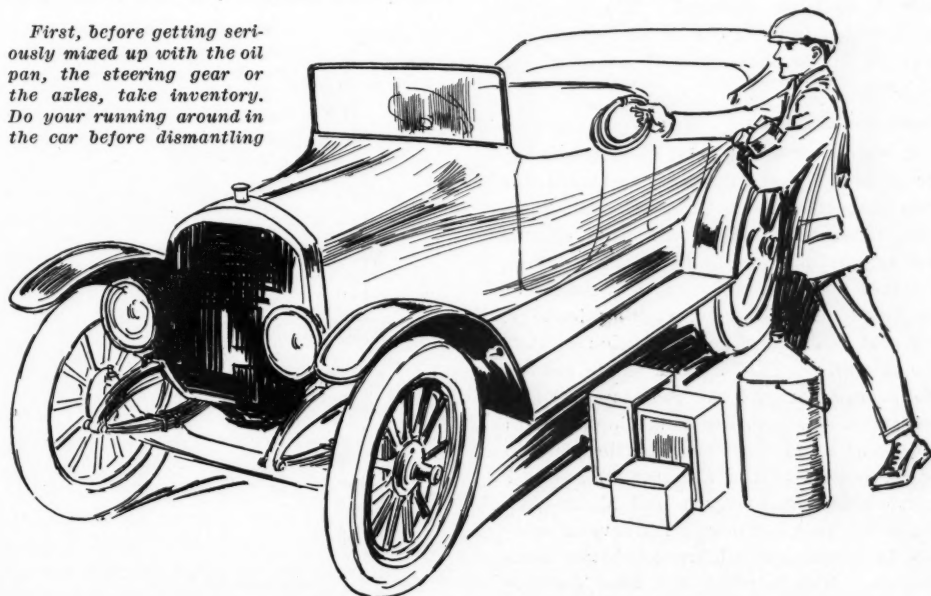
Different Engine Designs

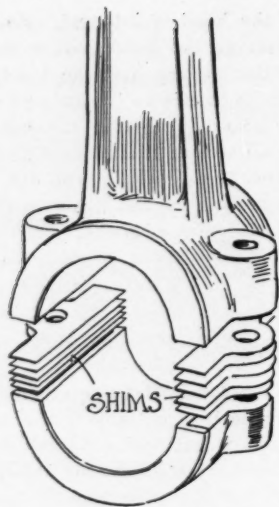
In some designs of motors the gearcase at the front is entirely separate from the rest of the engine so far as its oiling is concerned. A heavy gear oil is used, and this should be drained out and replaced by new lubricant after several treatments of the gears with kerosene. Put a quantity of it into the case, turn the engine over a number of times and then drain it. In case you have had to take off the radiator it might not be a great deal of trouble to remove the cover of these gears or chains, as the case may be, and then a very satisfactory job of cleaning out any gummy oil can be done. A sponge soaked in kerosene is good for this work. When putting the gear cover back on, cut a new gasket out of heavy paper, for there must not be leakage of the oil. Spread a little grease along the edge of the cover and then lay it flat on the paper. The grease will make it stick and then the outline can be marked and cut with a sharp knife or the edge can be tapped with a hammer and the outline thus made.

Having allowed the crankcase and the oil pan to dry thoroughly, this is a good time to put the bottom part of the crankcase back in position, after having cut a new paper gasket as just outlined.

A word on gaskets in general might not be amiss here. Joints to hold water, air or oil require different gasket materials because the action in each case is different. The water joint can best be sealed

First, before getting seriously mixed up with the oil pan, the steering gear or the axles, take inventory. Do your running around in the car before dismantling





Put shims in between connecting rod joints

by using sheet asbestos that has been coated with graphite and then shellacked. Do not use too much shellac either, because it might be squeezed into the water space and later cause trouble. For the intake manifold, a good gasket can be made from graphited asbestos also, but for sealing the joint between cylinder and exhaust connection copper covered asbestos is best. This can be bought at the supply stores and comes in the right size for almost any installation.

Run a long wire through the oil pipe connections, the pet cocks and the drain holes to make sure they are all open and free, and then you ought to be through with the engine proper. Next examine the cooling system. If either of the water connections between motor and radiator are in bad condition it would pay to replace them. Sometimes old rubber hose gets rotted within and this may obstruct the free passage for the water although not showing outside. See that the clamps that connect the hose to the radiator and cylinders or pump draw down properly and do not bind at any point so that the rubber is bunched. This may be a source of leakage. Old clamps are seldom of use once they have been removed. The removing of them bends them out of true round and they never go back on with an even pull all around.

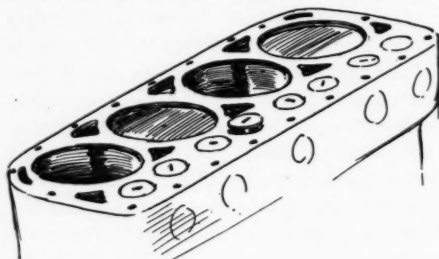
Clean the Radiator

It would be well to clean out the radiator thoroughly after having removed the hose connections. In doing this, never use acid, for though this would take off the rust or possibly any incrustations within, it would also eat the metal and solder of the tubes or cells, soon causing leakage. The best thing to use is a solution of soda in hot water. This can be made readily and poured hot into the radiator, the bottom outlet of which has been plugged with a piece of wood. Let this solution remain for some time in the radiator—possibly 1 hour. Then drain it out and allow pure cold water to run through for several minutes to clean out all trace of the soda solution. Now replace the hose connec-

tions and fill the system with water again to examine for leaks. If there is a water pump see that the packing glands are in good condition. If they are worn out so that water gets out onto the pump shaft, some wicking should replace the worn out material within the glands. This wicking can be secured from a steamfitter.

Examine Carbureter

Everything about the engine should now be in ship shape except possibly the carbureter and the ignition and electrical units. Little can be done to the starting and lighting outfit save making a general inspection. Examine for loose connections, see that the insulation is in good shape, and if any of it is rotted, replace that wire with one of the same size and insulation properties. About the only useful thing you can do to the starter and generator is to dress the brushes and possibly sand-paper the commutator lightly to clean off any coated grease or dirt. Very fine sand-paper carefully used will do the trick. If a wire has its insulation worn at one spot, it would be well to tape it even if the



Cylinders with heads removed for cleaning

insulation is still not worn through. This may prevent a short circuit or other trouble later in the summer.

Above all do not take the magneto off, if you have a magneto. This also applies to the battery types of ignition distributors. Move them from their position and you will have to reset them which is a tedious job unless absolutely necessary. Clean the ignition apparatus thoroughly and especially the distributor and breaker mechanism. Moisten a cloth with kerosene and rub the mechanism clean of all dirt.



Grind the valves

Then wipe this off with a dry cloth. If you want to check the ignition timing, bring the first cylinder piston up to top dead center ready for firing. Then see that the distributor makes contact with No. 1 cylinder and examine the breaker mechanism. With the breaker box in retarded position, the breaker points should be just ready to separate.

You are about ready to leave the motor and start on other parts of the chassis, but before you do, take up any slack in the fan belt by the adjustment that is usually provided, and then go over the entire engine with especial thought of finding loose bolts or nuts. See that the bolts that hold the engine to the frame are tight, check your own work carefully and then forget about the motor, for you have other fields to conquer.

Next to the motor comes the clutch, and it should now have some attention. If a cone clutch you can renew the worn leather by inserting a thin saw blade between it and the flywheel cone, roughing the matted down surface somewhat. Neatsfoot oil should also be used to advantage. Prop the clutch out of engagement by putting a stick between the pedal and the front seat. Spread the oil on evenly and let it stand for a few hours to soften the leather. You know from driving the car just how badly the clutch acts, and this will govern the thoroughness with which you attack it. Ordinarily, the oil treatment will suffice for any leather faced cone clutch. If the leather is very badly worn it should be replaced, but this is a big job and entails getting the cone out.

Let Dry Disk Clutch Alone

If the clutch is a dry-disk type, you are advised to let it alone entirely, unless there is something you know to be the matter. If a disk type running in oil, drain out this lubricant and flush the clutch compartment well with kerosene. After this has drained, put in some clutch oil or medium engine oil to which an equal amount of kerosene has been added. Put in only enough to submerge the lower portion of the plates. Don't use a heavy oil as this would gum the plates and prevent proper driving connection.

Next drain the oil out of the gearcase and replace it with a transmission oil that is a little heavier than that you use through the winter months. This should be put in to a level that will just allow all of the mainshaft gears to dip in it on their lower side. Too much oil will surely find its way out. See that there is no leakage around the gearcase cover, and if there is put in a new paper gasket and tighten the plate well, using lock washers.

Right here is a good point to caution you about the oiling. As you proceed, keep the oil can close at hand and give all joints and friction surfaces a supply of oil. This applies to the clutch mechanism, pedals, gearshift lever and other connections. See that there are no rattles in any of these joints, and remove any rust you may find.

While proceeding along the chassis, do not forget the universal joints. Remove the covers and clean them thoroughly with kerosene, allowing it to dry before repacking them with graphite or grease. Then put the cover in place and replace the leather boot if there is one. Examine the brake rods and clevises and oil the joints well. Work them back and forth to see that there is no restricted motion, all bearings being free. Examine for any rattles in the rods and take up any unnecessary slack by removing the clevis pin and turning the buckle up on the rod a sufficient amount. See that each brake works properly on its drum, and make sure the bands and connecting parts are free but not so loose as to rattle. Recently Motor Age went into the subject of brake care thoroughly and the detailed instructions given should be followed. It is quite a job to replace worn brake linings, and unless you have the time to spare, it might be better to have a repair man put on new ones for you.

Adjust Rear Axle

Coming to the rear axle, remove the cover at the rear of the differential housing and unless the lubricant is in good condition it ought to be entirely cleaned out and replaced by new grease or heavy oil. Here a sponge will come in handy for getting into the inaccessible corners. Kerosene will also help, and after getting all dirt or grit out, pack in new grease and replace the housing cover, being sure that the gasket is in good shape. Here also a heavy paper will make a good gasket if needed.

There ought not to be anything else to do to the axle unless you know it to be out of adjustment. Space will not permit of detailed instructions for adjusting the axle gears, but this has all been explained in previous issues. Adjusting axle gears is a delicate thing to do, and unless you have had some experience with this work, you are advised to call in a repair man for an hour or so.

Do not forget about the steering gear and steering connections. These are very

important and any play in the reach rod or cross rod will cause rattle. You can readily discover the means of adjusting these properly, and at the same time do not forget to grease and oil them properly. Examine the front wheels to see that they are properly lined up. The first thing is to make sure that the wheel bearings are properly adjusted. They should be just tight enough so that there is no side play in the wheels, but they should not be so tight that the wheels bind and do not turn freely. This done, take a stick that will reach from the inner edge of one rim across to the inner edge of the other. Then measure the distance when the stick is horizontally back of the wheel center. This distance should be $\frac{1}{4}$ to $\frac{3}{8}$ inch greater than the distance when the stick is held horizontally in front of the wheel centers. Then oil the steering gear, and if there is too much play in the wheel it should be taken up. The wheel should not admit of over one-quarter turn without action. Some drivers prefer less than this.

If you take the wheels off and clean the bearings, do not dip them in dirty gasoline that has been used for cleaning other parts. This is apt to be full of metallic particles that would hurt the bearings. Dip them in a hot solution of soda and water, and then immerse them in clean kerosene. This will put them in good condition. Use plenty of grease in putting bearings on the axles again and in fitting the wheels into place.

There only remain a few minor things to do. The springs should be looked to carefully, and if you have been annoyed with rattling spring bolts, the best thing to do is to replace them. Put some graphite or oil between the leaves of the springs, either by using one of the handy patented leaf spreaders or a cold chisel. The latter is to be discouraged, however, unless you use it carefully and refrain from marring the paint. Jack up the car so as to take the weight off the spring before attempting to force the leaves apart slightly.

Tires May Need Attention

Do not forget the tires in this general overhauling. It is best to take them from the rims and remove all rust. Then graphite the rims and the tires will repay you for the trouble. While you have the shoes off you should examine them for bad bruises and cuts and see that the side walls and beads are in good shape. Use French chalk freely in putting the tubes in place.

Nothing has been said about the storage battery, but it is taken for granted you will have it put in good shape. If there is a battery station in your city you are advised to let them give it a good overhauling and complete charging while you are repairing the car. A series of articles on battery care has just been completed in Motor Age, and if you care for the battery yourself you can profit by the instructions given.

Up to this time we have neglected the body. This was done purposely, for in the general overhauling you are apt to get some grease on it, and it is best to wait until everything else has been done before cleaning it. Apply plenty of pure water and use soap that you are sure is free from chemical cleaning agents. Linseed oil soap is not detrimental to good finish, but chemicals are. Sponges should not be rubbed across the finish, but the dirt soaked off to prevent scratching. Much of the secret of a good-looking body lies in the polishing. Apply a good polish with a soft flannel cloth, and gently rub the surface dry with another.

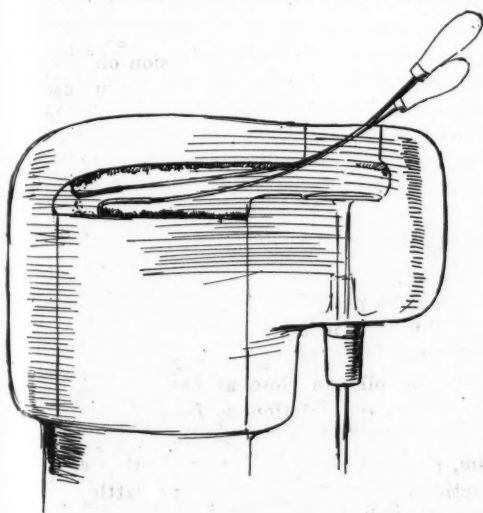
HORSES AT OVERLAND'S FACTORY

Toledo, O., March 24—Among the curiosities of the motor car industry are the three horses used in patrolling the grounds of the Willys-Overland plant at night. These are the only horses ever seen about the great establishment.

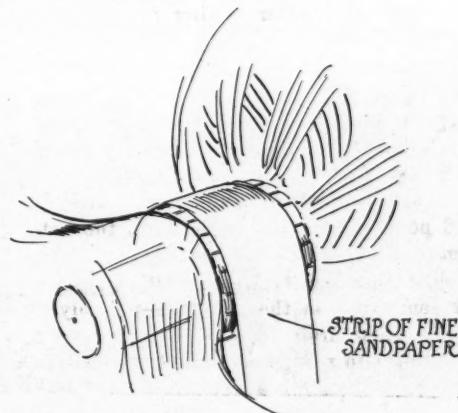
The 16,000 employees who travel to and from the factory every day utilize almost every known means of transportation that the city affords. Trolley cars, motor cars, bicycles, motor cycles and jitney busses all carry their quota of passengers to the plant but even in this maze of power-driven vehicles the horse is seldom seen.

But after the whistle blows at night and the army of day workers have departed for home the three horses make their appearance, entering the grounds along a footpath at the rear of the factory. They are the mounts of the Overland night watchmen, who keep in touch with forty-five other men stationed around the freight yards and factory buildings. Throughout the night they police the Overland property and it is said to be next to impossible to get through their sentry lines without being challenged.

This system of protection is imperative owing to the huge quantities of material that come into the plant at all hours of the night. The dockage facilities for taking care of inbound freight extend over a distance of 4,900 feet. Some idea of the volume and value of freight received at the Overland can be gained from the fact that during the year 1915 the company paid out over \$800,000 for freight charges on inbound shipments alone.

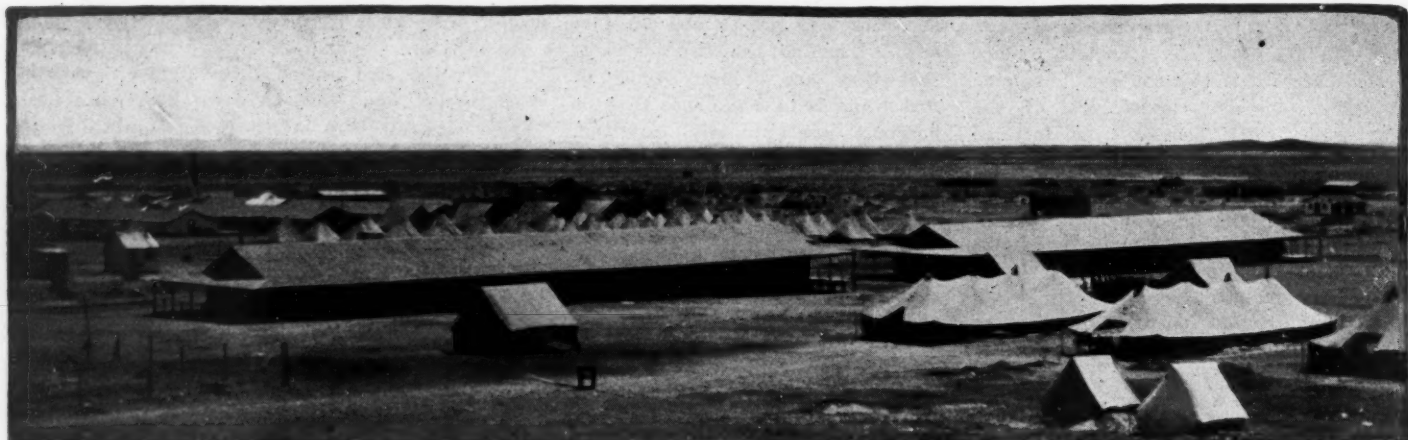


Clean the cylinders and pistons of carbon by scraping



Use sandpaper to clean commutator

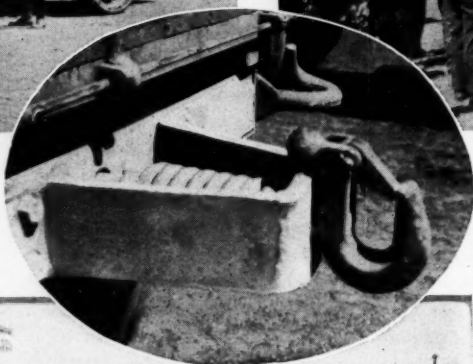
Motor Cars Figure Strongly in U. S. Mexican Campaign



General view of camp at Columbus, looking toward Mexico over path taken by Villa in his flight. Picture taken from knoll behind which Villa left his horses on morning of the raid. Frame buildings in foreground contain dental and surgical departments.



Lippard-Stewart truck, used for distributing supplies in camp. Movie men find arrival of Jeffery trucks a good subject. In circle—The substantial coupling—rarely used—on back of each Jeffery quad.



Fate of American Army in Pursuit of Villa Depends on Trucks

By Hi Sibley

Motor Age's Special Correspondent on Mexican Border



Starting from camp on trail of lost motorcyclist

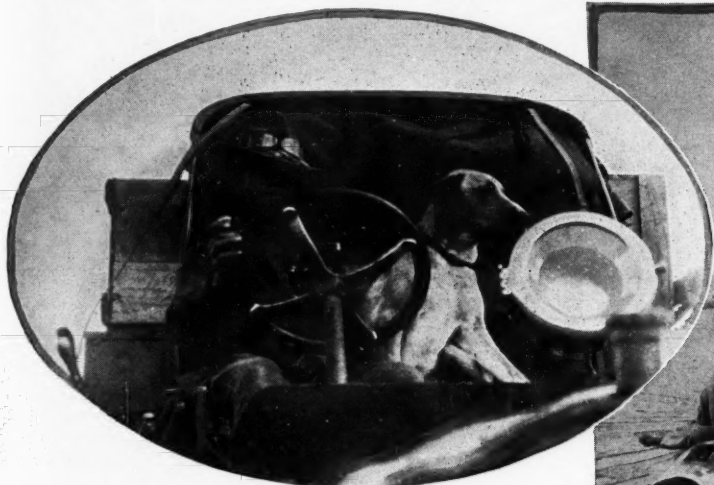


Searching party preparing to leave in one Dodge and three Ford cars

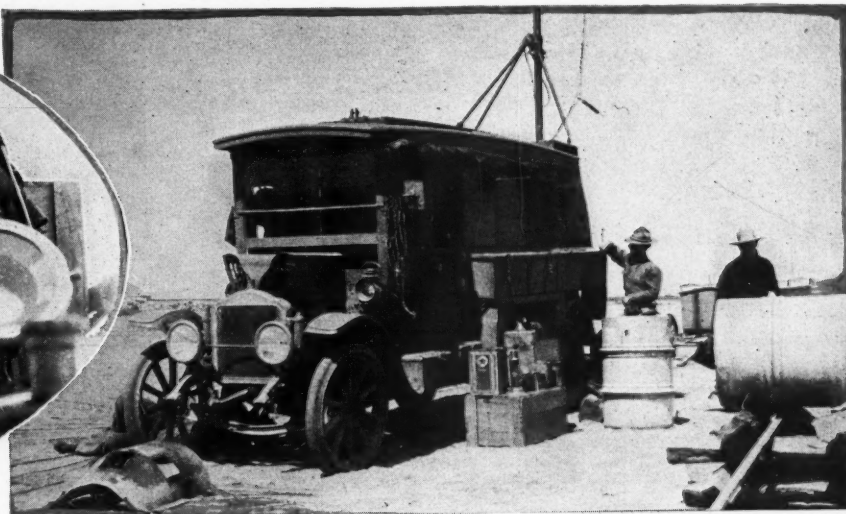
COLUMBUS, N. M., March 25—From a little knoll just north of the military camp at Columbus, one looks down upon the vast, sloping sweep of desert over the route taken by Villa in his retreat after the raid on this town. The air is remarkably clear and the mountains some 40 miles distant, stand out in sharp relief. Somewhere in the remote fastness beyond those mountains is Pancho Villa, covering space as fast as good horseflesh will carry him, well aware that there is a big price on his head, and also knowing full well that a regiment of dad-burned mad Texas rangers desire his head just on general principles. Pancho, they say, fears neither God nor man, but he has a devout respect for that superman, the Texas ranger.

The troops are pushing into the desert wastes at a pace never equaled by any body of fighters. Hourly they are getting farther and farther from their base of supplies; they are in a desolate, unproduc-

Experiences and Exploits of Vehicles in Punitive Expedition



"Bob," the camp mascot, who would rather sit behind the wheel than eat, and he's not shy on appetite, either



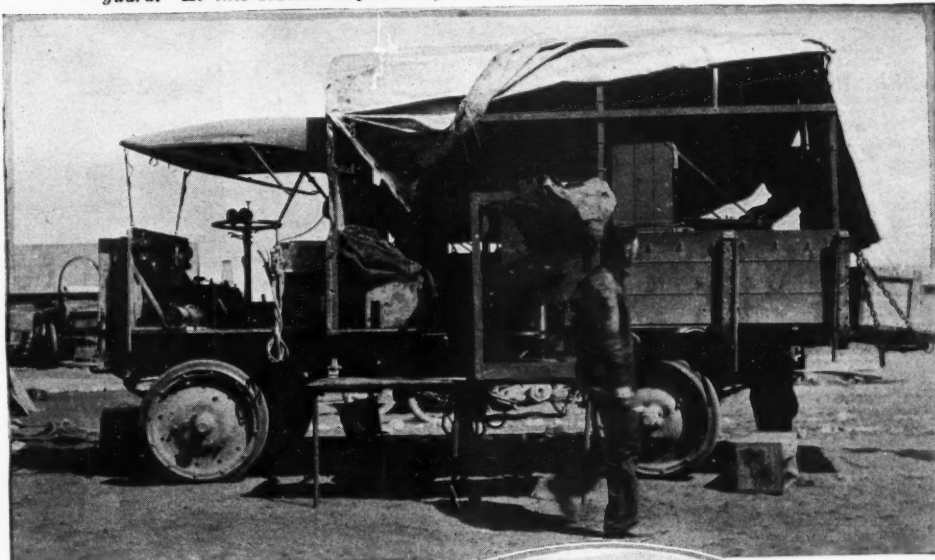
Wireless station on White truck. Isolated from rest of camp, and under heavy guard. At this station dispatches from the front are given out to the press

tive and undoubtedly hostile country. The problem of keeping up communication with this base is a most vital one, but it is being solved magnificently by motor trucks.

At this writing, communication with the troops by supply trains has not been interrupted. Trucks laden with food, fuel, water and necessities of all descriptions have made regular trips to the ever advancing front without mishap of any consequence. They have maintained their schedules. They alone have made this punitive expedition possible.

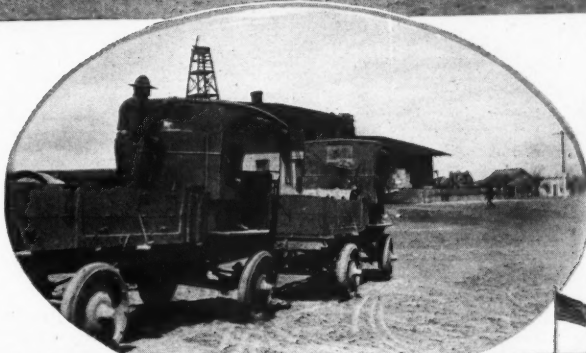
Day before yesterday there was great excitement in camp, for a squad of eight new Jeffery quads, manned by civilian drivers, recruited in Kenosha, were due to arrive in the afternoon completing their first round trip to the front. An hour before they were expected, the moving picture men had their cameras set up on the little knoll. Their number was augmented by newspaper photographers and reporters. Every one in camp was interested in the arrival.

"There they come!" shouted someone and all eyes immediately were focused on a minute cloud of dust on the horizon. It grew larger and larger as we watched; presently we could make out the cars, apparently moving at a snail's pace at that distance, but in a very few minutes we



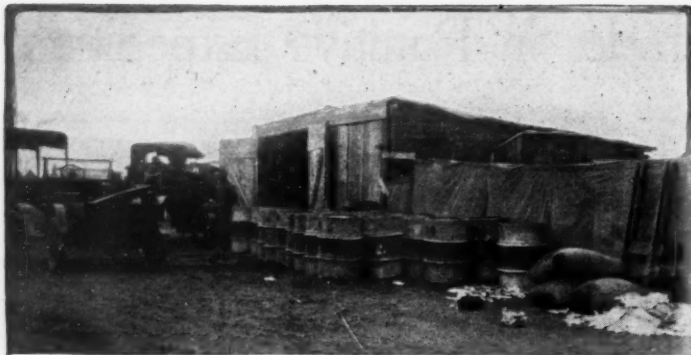
Completely equipped machine shop on Jeffery quad is shown above

A tow, but only because second car ran out of gas a few miles outside of camp. Below, some of the "post trucks" or cars used at camp only, taken at camp gasoline station



The only Jeffery that had a mishap. Owing to darkness driver ran into car ahead; but most serious damage was to radiator guard and wooden body boards





The gasoline filling station at Columbus, the starting point of the trip into Mexico



Fuel for the four-legged transports. Baled hay from railroad to cavalry headquarters



Loading up with gasoline preparatory to return trip with supplies for the army at the front



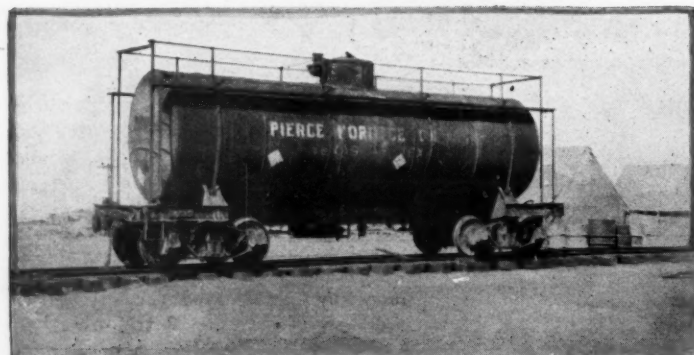
A dispatch rider filling up preparatory to a fast trip to the front, 150 miles over desert roads



Fifty motor trucks arrive at El Paso to be sent to Columbus for transportation of supplies, etc., to the front



The first Jeffery quad to make round trip to the front at Casa Grandes and return

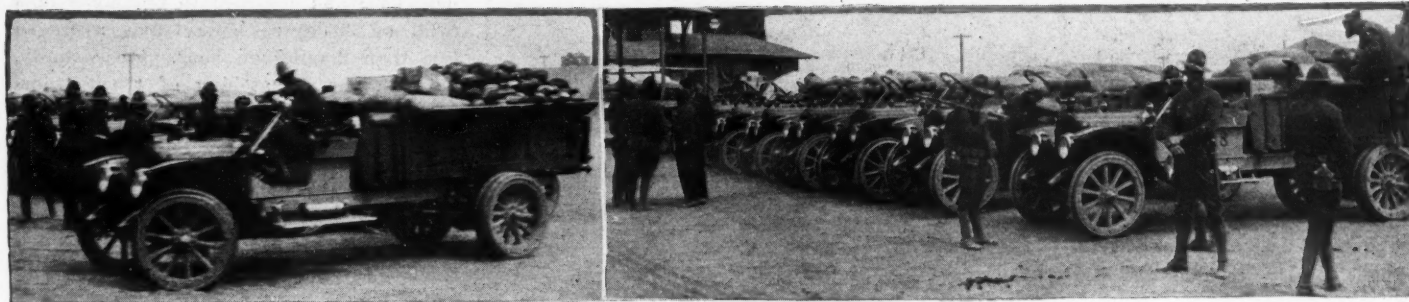


Main gasoline supply. Tank car run into camp over a spur from El Paso and Southwestern Railway tracks, built especially for convenience in transporting camp supplies



All that was left of a Ford that stood in front of burning Commercial Hotel the morning of the Columbus raid by Villa and his Mexican bandits from across the border

White Trucks Carry "War Babies" Across Mexican Border



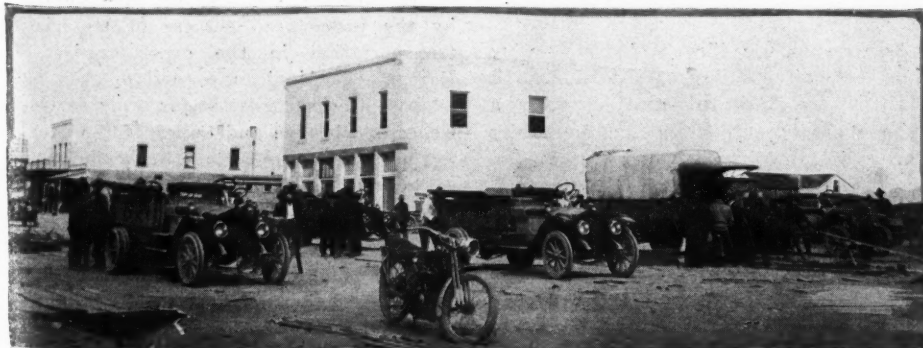
Oval, train of Whites on their first trip across the desert from Columbus with rations for the field base at Casa Grandes

Upper left, loads of "War Babies," the name given the French bread by the U. S. soldiers in Mexico

Upper left, fleet of Whites loading for the front



Loading White army trucks at the quartermaster's department at Columbus



Army carpenters fitting bodies on the chassis 30 minutes after their arrival at Columbus

could hear the exhaust of their motors, and they soon rolled into camp, dust-covered, wheels caked with mud, crews begrimed almost beyond recognition, but triumphant amid our cheers.

In the first lot were only six cars, but a short time afterward the two remaining hove into sight, one towing the other. It developed, however, that there had been no breakdown, but one of the cars had run out of gasoline, and to save time consumed in transferring a supply, the empty truck was hooked on to the other and they came in with no perceptible diminution of speed.

The drivers were well-nigh worn out; the condition of the roads had been anything but desirable. Where there was not deep sand they encountered sun-baked mud, which cracked and assumed a rutty condition. There had been little opportunity to rest, and they had pushed through with few stops, making the round trip of over 300 miles in 72 hours. It was a novel experience for the civilian drivers and a fine test for the efficiency of the trucks in ac-



Moreland trucks with General Calles army at Guaymas, Mexico

tive service in warfare. There was only one minor accident, in which one car crashed into another in the dark, but suffered only a bent radiator guard and a slightly splintered body. None of the mechanism of the car was impaired in the least, and it was ready for the return trip that same afternoon.

Before dust, the entire squad set out again, laden with gasoline, hay, and general supplies. A guard of five soldiers went on each car, and military chauffeurs manned the quads. They probably passed the White trucks which are reported running on schedule.

The motor car division in camp is pretty well equipped to care for and repair the cars. A complete machine shop is mounted on a Jeffery quad, fitted out with a motor-driven, 9-inch Seneca Falls lathe and a 16-inch Hisey-Wolf friction-driven drilling machine. Both are motor-driven from current supplied by a generator belt driven off the truck motor. Neat lockers and cabinets contain systematically arranged tools of all descriptions required in a repair shop, and repairs of all sorts are taken care of by this department with facility.

Motor cars play an important part in all the military departments. Nearly every officer is equipped with a runabout, dispatch riders use motorcycles and runabouts, the wireless outfit is set up on a White truck, and even the cavalry has its allotment of cars.

White Trucks in Service

The transportation of supplies from the border to the front, which has been one of the problems of the Mexican expedition, is more dependent on motor trucks than on mules. In fact, this is the first time in actual American war service that the motor truck and the mule have been pitted against each other under the worst conditions to be encountered in military service. And those who have observed the

work of both mule and motor freely assert that the present campaign in Mexico is the last stand of the army mule.

For army transport work the war department has formed several units known as "motor truck companies," each consisting of twenty-eight trucks in charge of a truckmaster, with three assistant truckmasters, twenty-eight drivers, one mechanic, one mechanic's helper and one machinist.

Work of the Whites

The work of one of these companies during the first week of service revealed the superiority of trucks over mules not only in the greater speed and capacity of the trucks, but in the reduction of labor, hauling units, forage and cost of operation.

One of the first units to reach the front was the truck company composed of twenty-eight Whites. These trucks, ordered by long distance telephone on March 15, were shipped by special train on March 16 and arrived in Columbus on March 19, only 4 days after the advance column had crossed the border.

In less than 6 days after the order was given to the White Co., the first detail of White trucks had reached Casas Grandes, the field base, with about 20 tons of rations.

As soon as the Cleveland trucks were unloaded on the siding of the El Paso & Southwestern Railroad at Columbus, a force of army carpenters and mechanics fitted with trucks with bodies of the field-wagon and cavalry-wagon types.

All of the bodies were mounted in one day and the first division of Whites, consisting of twelve trucks, was sent across the border to begin the 130-mile run through the desert sands and rough mountain trails to Casas Grandes. Each truck carried two soldiers. The drivers of the trucks, selected from the White factory,

were in civilian attire. Only the troopers carried arms.

This division delivered its load at the field base and returned to Columbus in a total of 3 days. Mule teams averaged less than 2 miles an hour. Occasionally, between the dispatching of truck transports, a few old-style army field wagons were sent across the border. These wagons, carrying no greater load than the trucks, were pulled by four mules.

The second division of Whites to leave Columbus consisted of seven trucks which started from headquarters at 5:30 p. m. on March 21, with a load of supplies for the aviation corps at the front. This load consisted of rations, gasoline, oil, tents, spare aeroplane parts, knock-down hangars, etc.

By starting out late in the afternoon on a day when apprehension was felt for the safety of two missing aviators, this division attracted considerable attention at Columbus. Even the hour of setting out across the desert suggested the urgency of the trip.

The third detail from the White truck company consisted of five trucks which left Columbus at noon on March 22, carrying twenty huge drums of gasoline and oil. The immense quantities of gasoline and oil required by the various fleets of army transports, aeroplanes, despatch cars and motorcycles presented a difficulty almost as great as the difficulty of getting an ample supply of water for the troops at the field base.

Many of the rivers, wells and water-holes were either polluted or poisoned, making it necessary to transport practically all of the drinking water used by troops and horses. For this purpose, the war department placed a rush order with the White Co. for three tank trucks of 600 gallons capacity each, and these trucks are now in service.

In addition to the carrying of supplies from the border to the forces in the field, motor trucks are performing an equally important work of an entirely different kind. Communication between Columbus and the advance column in Mexico is maintained by motor trucks equipped with radio sets.

MORELAND TRUCK IN MEXICAN ARMY

Los Angeles, Cal., March 24—Profiting by the pronounced success of motorized transportation in the great armies of Europe, the Mexican council of war has adopted the motor truck for army service. Generals Obregon and Calles of the Mexican army sent requisitions to headquarters calling for a fleet of trucks.

Senor Baldermo A. Almada, purchasing and confidential agent of the republic, placed an order with the Moreland Motor Truck Co., Los Angeles, calling for immediate delivery of four Morelands of the 2½-ton type. Time was an important factor, so the initial order was sent to the front by express.

When the recent Moreland military demonstration to San Diego was first contemplated, Manager Watt L. Moreland determined to build the truck bodies according to U. S. army specifications. This plan greatly simplified the selection of bodies for the Mexican trucks, for when shown the ones used in the now nation-wide mobile maneuver, the Mexican army official immediately approved them. There was only one change to be made. The lettering was changed to *Cuerpo de Ejercito del Noroeste*, meaning, Headquarters of the Army of the Northwest.

Formalities necessary in passing the custom house had been quietly arranged in advance and the Morelands were sent over the border without delay. Arriving at the war zone, the distillate burning trucks were unloaded and placed in service without ceremony. Their success was both immediate and pronounced. They were deficient only in number. A second requisition was forwarded to headquarters, but this time the name Moreland was prominent in the demand.

Little had been heard of the trucks at the Moreland plant since their departure for the front and no small amount of surprise was expressed when a wire arrived calling for the earliest possible shipment of six additional trucks.

The suppression of the Yaqui Indians now giving so much trouble in the Yaqui valley has been greatly retarded owing to inefficient transportation facilities, but according to word received from the front this movement has taken on a new phase since the arrival of the trucks.

RAYBESTOS GETS INJUNCTION

New York, March 25—The Royal Equipment Co., Bridgeport, Conn., manufacturers of Raybestos brake lining, has just had a permanent injunction issued by the United States district court, southern district of New York, against Max Rich, trading under the name of the Rich Auto Supply Co., New York, restraining him, his agents, or those acting or claiming through or under him directly or indirectly, from using the word, brand, or trademark "Raybestos" alone, or in association with other words, mark or design, or using the silver-colored edge in connection with the branded silver edge Raybestos, or offering for sale brake lining for vehicles not made by the complainant, or any other word, brand, mark or name, or colored edge so nearly like the complainant's trademark Raybestos as to be calculated to mislead or deceive the public or intending purchasers into the belief that such goods so sold or offered for sale are the Royal Equipment Co.'s goods.

A great deal of substitution for Raybestos has been going on during the last few years, and the Royal Equipment Co. is determined to put an end to this substitution, if necessary to institute proceedings against each offender.

Packards Off for Mexico

All Time Records Broken in Shipment of Twenty-seven Machines

1000 Employees Strive to Enlist in Motor Transport Company

DETROIT, Mich., March 24—In less than 22 hours after receipt of an order Monday night for twenty-seven war trucks, a special Packard train of fourteen steel freight cars and one Pullman sped away from the factory bearing thirty-three recruits for the motor transport service on the Mexican front.

The train was scheduled to make the trip to the Mexican border in 51 hours, the fastest time that has ever been made from border to border. The government ordered all tracks cleared for this train but refused to state its exact destination.

A stirring scene was enacted in the Packard truck shops Tuesday morning when officials of the company called an assembly of the workers and asked for volunteers to enter the army for immediate service in Mexico. One thousand men shouted, struggled forward, raised their hands and waved them madly, to signify their willingness to volunteer for service. The thirty-three men finally selected were given 6 hours to get their effects, settle their business affairs and say goodbye. It may be the last farewell for some of them, since the war in Europe has shown that the transport department of the army has dangers.

As an advocate of preparedness the Packard company has shown its ability to deal promptly with an emergency. A special night shift of workmen was listed for call and was at work in the truck shops in less than 2 hours after receipt of the

instructions from the war department. Trucks of the required capacity were ready for the final assembling operations so that they could be put in shape to meet government inspection. An advertisement for truck drivers to fill the places of men required for duty at the front appeared in print Tuesday morning.

The truck master who accompanied the expedition carried with him the detailed instructions of the war department relative to the operation and maintenance of motor transport. Copies of this information had been secured from Washington in anticipation of the call.

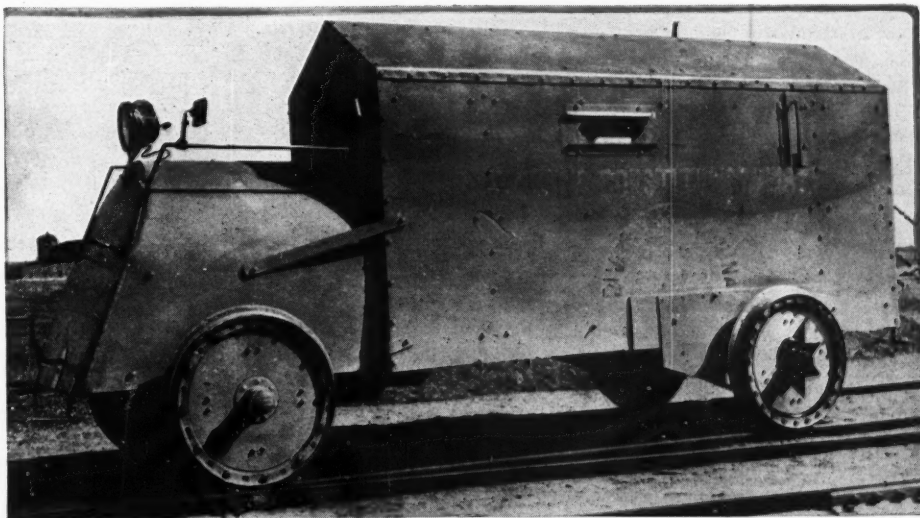
The "Americans First" policy originated by the Packard company has awakened a deep sense of loyalty among native and foreign-born workmen as well. Men who had come to Detroit from various European countries competed with the American-born employees for the privilege of going to the front in Mexico.

PAIGE BOOSTS "AMERICANS FIRST"

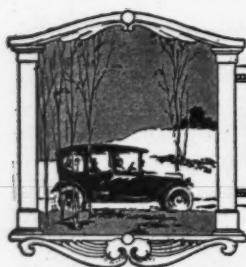
Detroit, Mich., March 27—Every foreman in the Paige shops has been notified that a Citizenship Bureau has been created and put in charge of F. L. Jewett, assistant to the president, and W. A. Wheeler, production manager.

Now every man in the Paige shops understands that he will not only be encouraged but helped in every possible way to go through the necessary formalities for securing his first and second citizenship papers that will make him an American with all the privileges that citizenship confers.

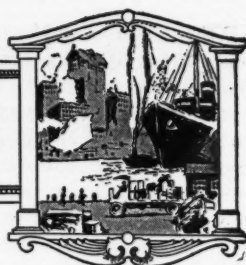
The results, so far, have been most gratifying. The number of men who are earnestly interested in American citizenship, as reported by the Paige factory citizenship bureau, is an indication that many foreigners are simply held back from applying for citizenship by timidity or actual fear of the official red tape and formality surrounding this duty.



Villa's war truck. The interior of the armored body carries ammunition and rifles, and port-holes allow the machine guns to spit their deadly stream of bullets. The car is fitted with armored wheels for the operation on railroad tracks. By quick adjustment they can be changed to run over the road directly into "Zona Guerra." This armored truck was used by General Villa in his campaigns in northern Mexico against Huerta, and figured actively in many battles.



EDITORIAL PERSPECTIVES



Economy Tests

THE year 1916 should be a great one for gasoline economy tests; in short, we know of no other form of test that should stimulate more interest in these days when gasoline is aviating and car manufacturers are talking of higher-speed and more efficient motors. While economy tests are good, and are desirable, we want some rational form of test. Let the test be a real test, one that tells you something that may benefit the thousands of car owners, and not one that is understood by half a dozen who conducted the test and a few others intimate with them. When Minnesota defeats Chicago on the football gridiron we know what it means. Let us have the same thing with regard to fuel test.

FIRST: The test must not be one made over asphalt city streets and of a mile or 10-mile duration. The fact that a certain carbureter gives 32 miles per gallon on such a test is of no value to the car owner in Michigan who, using the same car fitted with the same carbureter, is only able to get 18 miles per gallon when driving with his family over the cement roads outside Detroit. Let the fuel test be a test of not less than 200 miles. Let the test be over regular country roads. Require that the carbureter adjustment be such that it is not necessary to shift gears any more than is intended. If good driving requires to shift gears on a hill on the test, then the gears should be shifted. Do not permit of coasting down hills until the car almost reaches a standstill. The test should be regular driving rules, the same as you or I would use if driving 200 miles in one day with our families.

SECOND: Make the speed a rational touring speed. Have the car carry its load of five or six or seven people, according to the body capacity. Have car and load properly weighted.

Take every precaution in measuring the gasoline and other matters with regard to the tests. Take every precaution with regard to the adjustment of the carbureter. Give the name, model, size of nozzle, details of valve springs, and every detail that the car owner using the same carbureter would want to have, providing he wishes to adjust his carbureter to get better results. Make it, in short, a commonsense test. Make it a test to benefit every car user. Do not make it a foolish test, one in which great mileage per gallon has been obtained by coasting down hills, or setting the fuel adjustment so fine that you can scarcely get up the hills and in which the accelerating qualities of the car are made too low.

GOOD, practical fuel economy tests are needed for 1916. They will aid in turning the attention of the tourist toward fuel economy. With higher gasoline prices the car owner wants to know more about saving fuel, wants to know how he can get more miles per gallon out of the gasoline.

THIRD: Rules for such tests must be general; they must be the same for Maine that are used in Illinois, Kansas, Texas or Oregon. With such rules a test made in Indiana is of some value in California, in Georgia or Mississippi. The American Automobile Association Contest Board should draft very complete sets of rules for such tests. The Contest Board should give its every energy towards stimulating such tests. Dealers and manufacturers should encourage such tests in different cities and different states. It is essential that such tests should be carefully supervised to see that every rule is strictly lived up to and that false performances are not imposed on the public. The best way to destroy the usefulness of any test is to let the results be misleading.

Shorter Speedway Races

IT is because the public can follow short-distance races in which four or five cars compete that they like them best, get more enjoyment out of them, and will go to see them once a month, whereas they do not care to see 500-mile races oftener than once a year. It does not tire them mentally to watch a real fight among five high-powered cars in an 8 or 10-mile race. Have the majority of the program of such events and if a 50 or 100-mile event is demanded by those in the trade place it at the end of the program.

THE short race often develops as many interesting phases as a 100-mile event. If one car pulls up abreast with another in a 4-mile race, the event brings the entire grandstand to its feet, but if it happens in a 500-mile race it does not create a quiver, because that can happen several hundred times before 500 miles are covered. On the other hand, if that should happen in the last lap of a 500-mile race and both cars were then on even terms, the incident would be one of the greatest interest stimulators in the entire race. The event is robbed of much of its interest because it does not mean much in long races.

IN any race those events that have a very close bearing on the final result are of greatest interest. In the baseball game a run that ties the score in the last half of the ninth is much more important as an interest maker than the second or third

run made early in the game. In the short-distance speedway race the brush between two cars with radiator to radiator electrifies the grandstand but passes unnoticed in the long-distance race.

LONG-DISTANCE racing has been overdone. We want more short races, 2, 4, 6, 8 and 10 miles. We must have them. We want more handicap events, in which cars are handicapped on former performances not on piston displacement or horsepower. Different cars should have their performances listed, and with this to go by a board of handicappers can provide one of the most interesting features of an afternoon racing by a close finish in a 10 or 20-mile handicap.

IT is an error to assume that there is more interest seeing two cars coming down the stretch radiator to radiator and traveling 110 miles per hour than there is with two cars similarly matched and traveling 80 miles per hour. Interest in any race rests largely in competition. No runaway race is ever interesting. No election for governor, president or president of the village board is interesting if it is all one-sided. On the other hand, have an election that is short and fiery, in which both sides are evenly matched, in which the tide of fortune apparently rests with one side and then with the other, and you will have an election that the whole community will take interest in.

Does Low-Grade Gasoline Cause Overheating?

Present Fuel Blamed for Lubricating Troubles—Thin Oil Is the Contention

CHICAGO, March 28—That a low-grade fuel, now being supplied the motoring public, is responsible for overheated motors, because a part of it that does not ignite leaks down into the crankcase and dilutes the lubricating oil, is the opinion expressed by Andrew Auble, president of the Akron Auto Garage Co., Akron, O. In a letter to Motor Age, he says:

"The discovery of a new condition in the oiling system of gasoline motors, I believe, is of sufficient importance to warn all users of motor cars today to be on the lookout for this trouble. The cause of this condition, after careful study, has been determined to be the condensation of a part of the gasoline which will not explode when the motor is cold or immediately after having been started on a cold morning.

"The present low-grade gasoline contains a large amount of kerosene and less volatile oils. This passing into the motor while it is cold passes the rings and the pistons and apparently condenses and mixes with the oil in the crankcase. Such a condition will naturally thin down the oil until it lacks all of its lubricating qualities, and if this condition is allowed to continue it eventually will ruin the motor. This is particularly noticeable in motors where the drivers are in the habit of using them for a few miles at a time and is especially noticed in small towns in the country, where it is a short distance to and from the various places of business, when the motor never gets hot enough to assist in evaporating the heavy gasoline procurable at the present time.

The First Symptoms

"The first symptom of this condition is the apparent economy of oil at the oil level, which remains at a standstill or shows a tendency to rise. In some cases it is necessary to drain the oil from time to time to keep the oil level from causing the motor to smoke. It will be found in draining this oil that it is very thin and in some places equivalent to kerosene.

"Careful attention and the frequent draining of oil anywhere from 500 to 1,000 miles and replacing with fresh oil during cold weather is the only thing that will guarantee the user against an injured motor from this cause. I have been in the motor car business for the last 14 years and have never known this condition to exist as it does now and believe it is a public benefit to warn all motorists to be on the lookout for this trouble, which is avoided so easily.

"Numerous complaints of fouled motors, even though they have been used but a few hundred miles, have come to my attention, motors which before this condition arrived never gave any trouble

in the accumulation of excessive carbon in the combustion chamber, and we have found this condition to exist in motors of practically every type.

"The average garageman or the average motorist immediately blames the oil. Then he tries another brand of oil and it does the same, and he shifts again and divides the responsibility between the oil and the car, until the cold weather is over and things right themselves.

"The reason for this I shall not pretend to determine. Possibly in the mad effort to make 3 gallons grow where before there was but 1, may be the answer. Apparently the lower distillates are so broken up that it all passes for gasoline long enough to be sold as such, but in the engine, on a cold morning, you may just as well try burning a mixture of gasoline and kerosene."

Mr. Auble has raised a question on which there is a diversity of opinion. In the first place, according to the oil companies, the specific gravity of the gasoline is not so much a factor in complete combustion as is the proper mixture coming through the carbureter. Of course, a great percentage of non-ignited fuel is

blown out through the exhaust opening of the motor, though some of it may leak past the piston rings and reach the crankcase, but if the pistons and cylinders are in good shape, if the piston rings fit and the compression is all that it should be, very little gasoline would get to the lubricant in the crankcase. Local authorities on fuels make the following points:

Granting that a part of the gasoline mixture is not ignited, and that the unignited portion crowds past the sloppy cylinders, is the onus not as much on the carbureter and the bad cylinders as it is on the gasoline? Would it not be just as reasonable to suppose that if gasoline of a high grade were drawn into the cylinders, when not properly vaporized, that it would reach the crankcase? Even if the gasoline mixture is all that it should be, an engine in which the pistons do not fit well might let some of the vaporized fuel into the crankcase on the compression stroke and thus affect the lubricant.

However, in either case, it seems reasonable to suppose that gasoline, which boils at 175 degrees, would vaporize quickly when brought into contact with lubricating oil at a temperature of nearly 300

See America First
• • • See America Now



EDITOR'S NOTE—This is the seventy-second of a series of illustrations and thumb nail sketches of the scenic and historic wonders of America to be published in Motor Age for the purpose of calling the attention of motorists to the points of interest in their own country.

NO. 72—OLD TAVERN AT SAN MIGUEL, CAL. DESERTED 40 YEARS

CALIFORNIA has many unique and interesting old structures, many of them marking epochs in the history of the Golden state. One of them is shown above, the old tavern at San Miguel, near Los Angeles. This was at one time a famous hostelry, but it has been deserted for more than two score years. It is built of adobe

degrees, if not dry out altogether and have little if any effect on the lubricant so far as thinning it is concerned.

It would seem that there are more angles to this question than just low-grade gasoline. Scored cylinders, bad compression, improper carburetion, all must be considered as contributing factors in the mixing of gasoline and oil in the crankcase of a motor.

PRICE QUIZ AT MINNEAPOLIS

Minneapolis, Minn., March 25—The city of Minneapolis, with the Automobile Trade Association and the Automobile Club, is investigating the reason for the successive 1-cent advances in gasoline prices. One hearing has been held with a representative of the Standard Oil Co. of Indiana testifying that the law of supply and demand regulates the price. Another hearing is to be held before the same council, March 24, on the use of gasoline by the fire department. Meanwhile, the city declines to grant the Standard Oil Co. a permit to build five filling stations.

NO TIRE CONSPIRACY HERE

Cleveland, Ohio, March 25—Holding that there was not sufficient evidence to support a charge of conspiracy against them, United States District Judge Killitz, sitting here, released the Firestone Tire & Rubber Co., Akron, and the United States Tire Co., New York, as defendants in a suit involving a million dollars alleged damages sought by the Automobile Co-operative Association of America, which claimed to have been put out of business.

The suit against the B. F. Goodrich Co. and the Diamond Rubber Co., and the Republic Rubber Co., which were alleged to have been in the conspiracy charged, was proceeded with.

Argo Business Is Sold

Mansell Hackett Buys Jackson Car Company

Former Disco Man Will Bring Out Larger Models

DETROIT, Mich., March 28—Special telegram—Announcement was made today by the Briscoe Motor Corp., Jackson, Mich., that a contract has been made with Mansell Hackett, former manager of the Disco Starter Co., for the sale of the Briscoe interest in the Argo Motor Co., Jackson. Mr. Hackett will take immediate charge of the Argo Motor Co., to which he will bring an entirely new organization, and it is anticipated that he will extend its business activities in a large measure within a very short time.

Mr. Hackett is well known in motor car circles and has made an enviable position for himself, putting on its feet the Disco Starter Co., which he purchased from a receiver. The Briscoe Motor Corp. will hereafter devote its entire time, organization and the new plants, which it recently acquired and has under construction, to the manufacture of Briscoe motor cars exclusively. Mr. Hackett states that it is the intention to continue the present Argo models for the time being, adding a light delivery car on the same chassis. However, large cars to sell between \$600 and \$700 will be brought out later, the plans being for a production of 5,000 the first year.

MOTOR CARS IN PERU

Washington, D. C., March 25—Because electric power is abundant and inexpensive in Lima, Peru, Consul General Will-

iam W. Handley, attaché to the American embassy at Callao-Lima, Peru, advises American business men that a field is open in that country for new trade in vehicles. The Commerce Reports of the department of commerce describe the status of the motor car in Peru as follows:

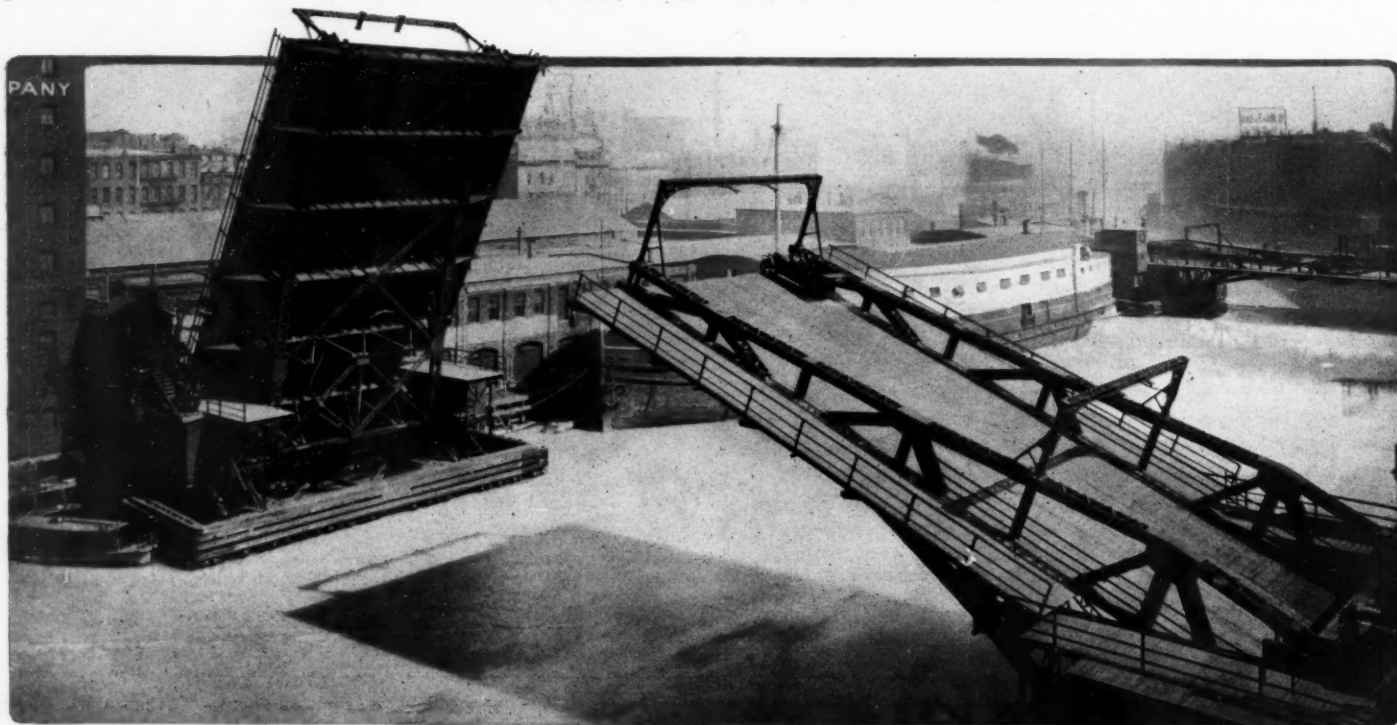
Lima is practically the only place in Peru where motor vehicles are used, and 300 motor cars is a liberal estimate of the number. The majority of these are in the taxicab service and are of American make. The private cars as a rule are of European make. The streets are narrow and not well paved. Outside of the city there are practically no roads on which motor cars can be run. There is only one electric vehicle in Lima and probably in the entire republic, so far as can be learned. Very few of the stores of Lima have delivery-wagon service, and there is only one motor in this service.

Electric power is quite extensively used in this district, and current for charging batteries could be obtained easily, at a reasonable price. The possible field here for electric vehicles is not large now, though with the abundant and comparatively cheap electric power there might be created a small demand for them.

LANE MOTOR TRUCK DEVELOPING

Kalamazoo, Mich., March 24—The Lane Motor Truck Co., of Kalamazoo, Mich., has been organized recently with a cash capital of \$25,000. M. H. Lane being president and general manager, G. E. Bardeen, secretary and treasurer. The directors are M. H. Lane, G. E. Bardeen and F. G. Gilkey. The company will build a factory at once and expect to begin manufacturing about May 1.

The company will bring out a light $\frac{3}{4}$ -ton, worm-driven truck, with a wheel base of 120 inches, and pneumatic, solid or cushion tires. The motor is $3\frac{1}{4}$ bore by 5-inch stroke, four-cylinder unit power plant, with a multiple-disk clutch. The rear axle is Sheldon worm-drive, with a gear ratio of 6.2 to 1. Wheels are artillery type, with square spokes. Tires, 34 by 4 inches, pneumatic, front and rear. Option of four different styles of bodies is offered.



To show the ability of Stewart vacuum-gravity fuel feed to take a car up a steep grade, a car was driven up an open jack-nife bridge over the Chicago river

All the Comforts of Home on Tour or Picnic Trips



WHEN is a dining room not a dining room? Likewise, when is a card room not a card room? And, then, again, when is a nursery not a nursery? Judging from the pictures shown above, the answer to these questions is the same in each case: namely, when it's a Studebaker car.

The owners of the car here shown, amid California surroundings, have taken advantage of one feature of the latest Studebaker models. This feature is the individual type, divided front seats.

In two of the views the front seats have been turned around to make possible the staging of a roadside luncheon and a card game, with the necessary tables. In spite of the size of the tables and the number of people, everyone seems to have plenty of room.

By reason of the fact that the front seats are not only adjustable, but actually can be removed, the view referred to previously as the nursery scene shows a baby in its cradle resting in perfect comfort to the right of the woman driver. The seat has been removed entirely and the cradle substituted.

Even in ordinary driving, this individual-front-seat feature has its advantages. The seats are adjustable, fore and aft, merely by releasing or tightening a set screw, so that persons of any size may be accommodated.

When the front seats are removed, baggage readily can be taken care of, or in case of a touring party camping out overnight, a cot can be stretched across from front to back in the tonneau of the car.

Ford Co. Barred from Business in California

Non-Payment of Franchise Tax Results in Ouster

SACRAMENTO, Cal., March 28—Governor Hiram W. Johnson issued a proclamation here today excluding from intrastate business in California about 5,500 corporations, including the Ford Motor Co., for failure to pay the state franchise tax of last year.

The tax in the case of the Ford company amounted to \$24,000, on which payment was refused on the ground that it was excessive. The company's intrastate business was reported at \$7,000,000.

W. F. Williamson, counsel for the Ford company, said tonight that the Ford branches in California would continue to do business. Necessary legal steps will be taken, he said. The courts may be asked to grant an injunction against the governor's order. Another method, he said, might be the nominal incorporation of various companies to carry on the intrastate business of the Ford company.

DISCOVERS NEW REFINING PROCESS

Savannah, Ga., March 25—Homer T. Yaryan, inventor of the process whereby rosin is extracted from old pine tree

stumps, announces that he has successfully concluded an experiment whereby commercial gasoline can be manufactured from a combination of kerosene and fuel oil. As a test, Yaryan drove his car several miles with this gasoline as fuel.

ADD TO LOOKOUT MOUNTAIN STRING

Detroit, Mich., March 27—Chief Engineer T. P. Chase, King Motor Car Co., has added another Lookout-mountain-on-high-gear record to his string. This time Chase piloted an eight-cylinder King over Lookout Mountain, Cal. He already holds a record for taking a King over Lookout Mountain in Colorado on the high gear.

ORDINANCE IS UNCONSTITUTIONAL

Milwaukee, Wis., March 25—The garage ordinance, which requires that the consent of property-owners be obtained before a garage is built in a residence district, was declared unconstitutional by the state supreme court on March 16. Lawrence Nehrbass desired to build a garage on Oakland avenue, Milwaukee, but was

refused a permit by the city building inspector. Under the modified ordinance, the building inspector is authorized to refuse to issue a permit for the erection of a garage when two-thirds of the property within 300 feet of the proposed garage site is being used for residence purposes. If Mr. Nehrbass demands a permit under the supreme court decision, the building inspector intends to refuse it under the new law and proceedings to test its validity will doubtless be undertaken.

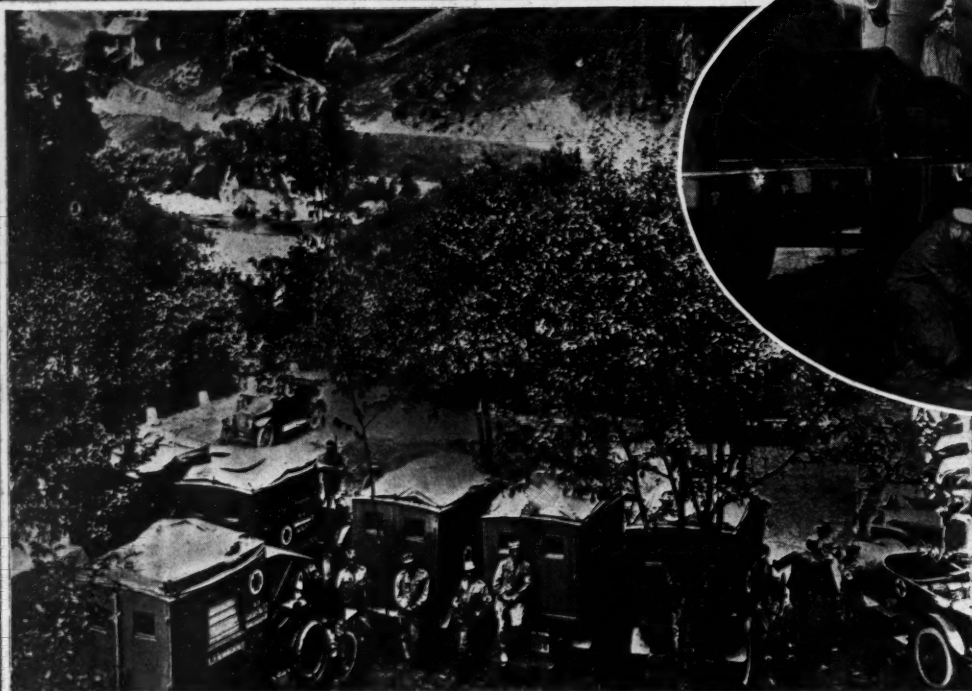
EXPLAINS GILBERT DECISION

Chicago, March 25—With reference to legal news items which have appeared the Gilbert Mfg. Co. writes as follows:

New Haven, Conn.—Editor Motor Age—There is some confusion in the trade concerning the decision of the United States circuit court of appeals in a suit of the Allen Auto Specialty Co. against former New York representative, E. G. Baker. News items appearing in December regarding the decree seem unfair to us in that they imply further proceedings and make no mention of our connection with this suit.

We wish to make it clear that the decision was in favor of the Gilbert Mfg. Co., Mr. Baker merely figuring in the suit as our New York representative.—E. G. Spalding, Gilbert Mfg. Co.

On the Austro-Italian Front



An Austrian ambulance column behind the front on the route of travel from the interior to the Austro-Italian frontier



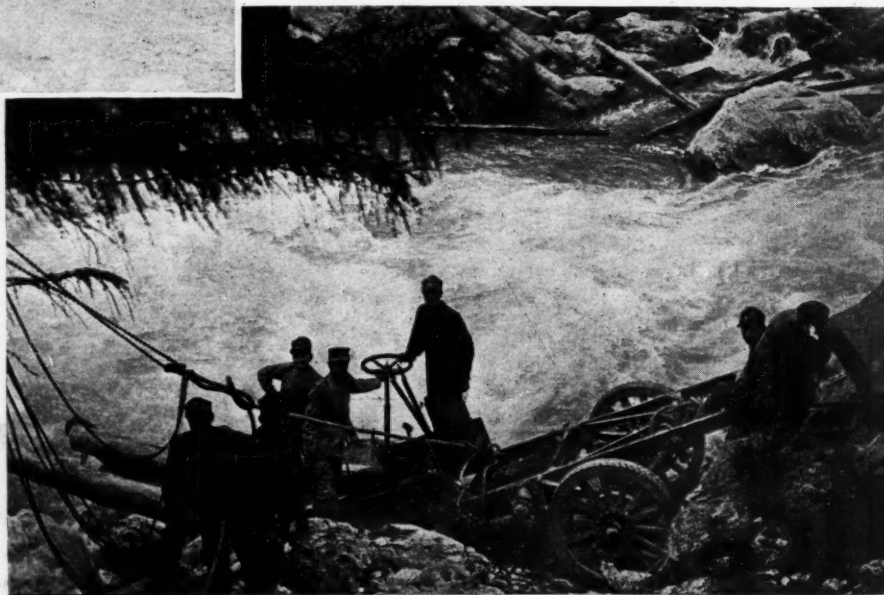
A motor truck driver fills his canteen at an Austrian station while train loaded with motor artillery equipment and armored cars halts for inspection a few miles from the firing line



Middle picture—A staff officer's Lancia car passing troops on one of the mountain roads in Italy. Where once were scores of pleasure cars which carried tourists from every country in the world over the winding roads amid peaceful Alpine scenery, there now is none but military machines



One of the supply stations from which Austrian troops receive fresh drinking water. The water is piped from mountain springs and hauled on trucks to the trenches



Lower picture—A time when block and tackle was needed to pull a tractor out of a gulley after an upset on a steep mountain-side in one of the difficult passes through the mountains back of the Austro-Italian front. Many are the mishaps that become commonplace during the war

Mortality of War Cars Found to Be Not So High as at Start

Highly Organized Traveling Repairshops



Manned by crews of picked mechanics and drivers, this train of motor transports constitutes a unit in a modern service system, run under military conditions for making repairs to the motor equipment of the allies, much as service stations in cities do for individuals

LONDON, Feb. 18—There is every reason to believe that England now possesses such a supply of motor trucks that no more orders will be placed in America. Confirmation of this is unobtainable, for only the military authorities are in possession of the full facts, and they refuse to make any statement or to give any indication as to conditions.

It is no secret, however, that there is a slackening off in the production of ordinary trucks for military purposes, and that deliveries can be made, under certain restrictions, to private concerns. More frequently, however, when the English factories are told to diminish their output of army trucks they are given other military work instead of being allowed to meet private orders.

England Sells War Cars

A very significant fact which tends to confirm the statement of England's sufficiency in the matter of trucks is the recent sale of a number of American trucks to Russia. This sale comprises 500 trucks of the make which has given the greatest satisfaction, originally bought for service in the British army, but since transferred to Russia.

A similar tendency is observable in France, where there appears to be a sufficiency of trucks for all immediate requirements, even supposing, as is quite probable, that hard fighting with frequent movements takes place during the next few months. For some time past only spares have been coming in for the five best-known American trucks used by the French and, although Velie recently has received a big order, there is every indication that France has now as many supplies from America as she needs for some time to come.

The popular impression that motor cars are short-lived in war service is not borne out by facts. One of the French armies,

located at a very active point of the battle front, has, roughly, 2,000 trucks, touring cars and special cars in service. The three repair shops attached to this army and established a short distance to the rear of the lines handle on an average 300 cars per month. Obviously, the number of cars going through the repair shops is a variable quantity, running high when there are attacks and falling very low when the opposing armies are inactive. The average of 300 repair jobs per month for a fleet of 2,000 cars is based on 1 year's operations and includes stationary trench warfare and a period of very fierce attacks. The cars comprise all French makes and five makes of American trucks, as follows: Packard, Pierce, Kelly, White, and Jeffery.

According to one of the officers in charge of one of the three repair shops, the American trucks give just as good service, on the average, as those produced by French firms. This officer, it may be mentioned, is in civil life the chief engineer of a French motor car firm producing a high-grade car. This officer, together with others engaged on repair work at the front, is of the opinion that he is

attending the finest school of experience in the world.

He states that in 12 months' repair work at the front, a practical engineer can acquire more data and more practical experience than in 12 years of peace conditions. It is thus a mistake to suppose that the engineers of warring nations are standing still while the war is in progress. They are able to examine and compare the working of all classes of cars—French, English, American, Belgian, Italian, and even German—under arduous conditions and in the hands of poor drivers. The reports which an observant engineer is able to send home to his factory are of an unusually valuable nature.

In this particular army, located in the Champagne district, with its repair shops only 25 miles to the rear of the front line trenches, it is found that the percentage of scrapped cars is very little higher than under peace conditions. There is more repair work to handle than in civil service, for conditions are more hazardous and drivers cannot be selected with the same care, but this does not imply a greater percentage of scrapped vehicles.



An American truck at a French railroad station which had its back broken when a 60-ton weight fell upon it—hardly to the discredit of the vehicle



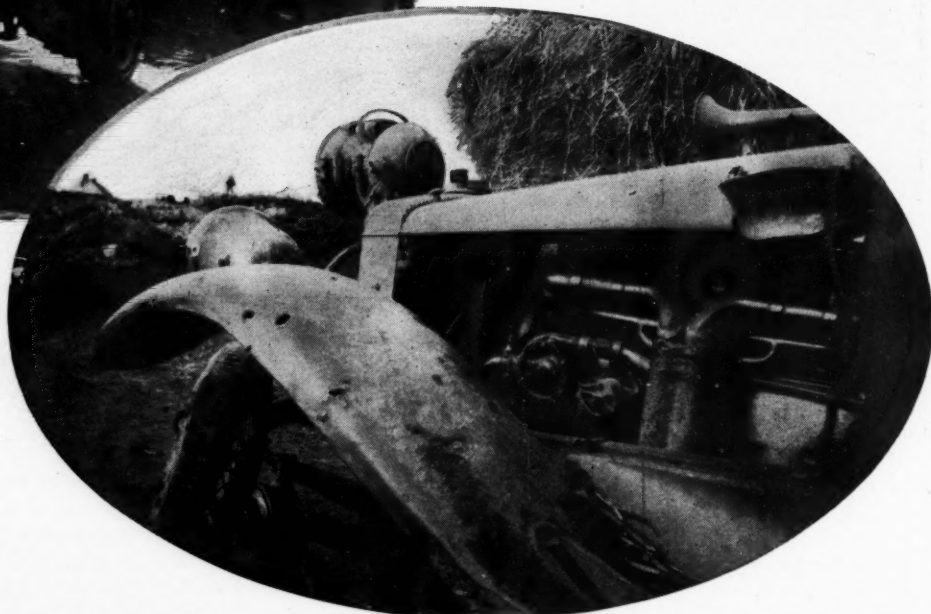
A wrecked motor truck being towed out of the fighting zone to the traveling repair shop behind the lines

It is surprising how difficult it is to put a car entirely out of business by shell fire. Bodies very frequently are destroyed by fire or by shells, but they are very readily replaced, and it requires a direct hit or very heavy shell fire to make a chassis unfit for further service. Even trucks which have come under direct fire and have had to be abandoned have been captured later, towed home and put into service again.

The diversity of the work undertaken by motor trucks is not realized by the manufacturer in America. In addition to carrying ammunition and food to the troops in the trenches, every truck is equipped for carrying men and also for hauling guns. An immense amount of trench-making material has to be hauled by cars, as well as men and material for making special roads. Under present conditions, the big guns rarely remain in one position more than 24 hours, and when it is required to remove them the motor trucks are called upon in preference to horses. This, of course, applies to the big guns, and not to the 75-millimeter field pieces, which are light and quickly removable by means of horse teams.

For Making Gun Roads

The necessity for frequent and rapid removals of big guns had been foreseen prior to the war, with the result that four-wheel drive tractors had been put into service in fairly large numbers. These, however, are not sufficient for all needs and ordinary 3-ton trucks are called upon to tow heavy guns. After being in operation for a day, the guns change position at night, with the object of keeping the enemy constantly guessing as to their exact position. As far as possible, gun positions are selected near roads. Where roads do not exist, they are made specially by the use of logs placed transversely on the track. Motor trucks



The Prince of Wales escaped death by a few moments when the bursting of a German shrapnel shell wrecked his car, killing the chauffeur. The shell exploded within a yard of the car. The mudguard was riddled with holes and the axle broken. It is the car used by the prince at Oxford

are invaluable for such work, for by their aid it is possible to build special tracks to gun positions in a night.

The motor car repair shops at the rear of the lines are capable of undertaking any kind of work, and yet can be moved to any new position within an hour of the order being received. This method of working is not common to the whole of the forces in the field. Some branches of the army, and particularly the British army, have permanent repair shops from 50 to 150 miles to the rear of the battle line, the damaged vehicles being sent to these shops by train, and returning usually under their own power. In these cases ordinary factory conditions pertain, and most of the men working in these permanent repair shops have never seen any fighting or heard a gun fired.

In the repair departments immediately behind the armies mobility is secured by mounting each tool on a special trailer truck. Two or three of these trucks are fastened up behind a car and hauled away to whatever new position may have been selected. The equipment comprises lathes, drilling machines, grinding machines, a case-hardening plant, and all the smaller tools required for general repair work. Electricity is made use of for driving the

machinery, a gasoline engine and dynamo carried on a trailer being provided for this purpose.

While it is essential that these repair shops should be self-moving, and capable of keeping pace with every advance or retreat of the main army, it is not necessary for them to work completely in the open. They can operate most effectively at an average distance of 25 miles from the front, and at this range it generally is possible to find buildings which can be readily converted to repairshop work. An abandoned factory, a tramway depot,

stables or a farm with a big courtyard, all form convenient centers in which to establish the repair depots. Such widely different localities as a village school and an abattoir are selected as places suitable for working in, while a factory with electric power is looked upon as ideal.

The units which are picked out as giving most work to the repairman are shackles and shackle bolts and springs. According to one engineer-officer, there is not a motor truck of any make or any nationality with really adequate shackle bolts. On war service these bolts are never lubricated by the driver; indeed they are generally in such a condition that it is impossible to lubricate them, and no provision is made for an automatic supply of oil or grease. The shackle bolts of a truck working over rough roads are subject to as much stress as the wrist pins within the motor; yet these latter are absolutely protected from dirt and are perfectly lubricated, while the former have no protection and little lubrication. In a rather less degree than the bolts, springs also suffer from the lack of lubrication and attention, although the breakage of springs is not as frequent as the breakage of bolts.

War service has shown that mechani-

cally-operated forced-feed lubrication to all motor parts is not as perfect as was generally supposed. One engineer-officer, who makes use of forced-feed lubrication in his own motors, has taken careful records of all lubrication troubles on trucks and touring cars with the conclusion that circulating splash gives the least amount of trouble. It is found that on war service care is not taken to change oil at sufficiently frequent intervals, poor oil is sometimes used, dirt is often poured into the motor with the oil, and by reason of the high pressure maintained these impurities are forced into the bearings.

This objection cannot be brought against forced-feed lubrication in civil life, for the driver or owner can be relied upon to exercise sufficient care to keep dirt out and change impure oil at sufficient intervals. With the ordinary circulating system to the important bearings and constant level troughs for the connecting rod ends, there is not sufficient pressure for dirt and particles of metal to be carried along and forced into the bearings. Under the rough conditions at the war the methods of oil filtering with forced-feed lubrication systems are altogether inadequate. It would appear advisable to have an oil reservoir entirely independent of the base chamber with some method of filtering equivalent to the oil filters and economizers used in factories. The oil tank independent of the motor has already been adopted on

some European racing cars, and also on the latest French aviation motors, but this has been done more with a view to keeping the temperature low than to freeing the oil of impurities.

War figures show that there is 20 per cent more bearing troubles where the forced-feed system is employed than with the circulating systems. This conclusion is significant in view of the fact that it has been arrived at by an engineer who was the first in France to develop the long-stroke high-speed motor and the first to lubricate with pure castor oil delivered to the bearings at high pressure.

Although clutches do not come into the repair shops for a great amount of direct treatment, yet war has shown them up as somewhat unsatisfactory and responsible for a good deal of damage to various parts of the transmission. In the hands of a skilled driver, or even with a man who takes an interest in his car, almost any kind of clutch will appear satisfactory. But unskilled army drivers, operating pedals through thick-soled boots or wood clogs stuffed with hay, very quickly find out the weak points of a clutch.

Even the best leather-faced cone clutches can be described as only moderately good under war conditions. Multi-disc clutches running in oil are rather better, but require attention to keep them in first-class condition. The only type of clutch which is fool-proof and with which an unskilled

driver can be relied on to change gears in a satisfactory manner is the single-plate dry-clutch. The war has shown the necessity for making clutches absolutely fool-proof.

There is nothing to indicate that the war will bring about radical changes in truck design, but it certainly will be responsible for numerous detail improvements and a large amount of simplification which will tend to the general betterment of commercial vehicles. There is not a single make but is open to improvement in some respect, and the war offers an excellent opportunity to wide-awake manufacturers to improve their product.

French firms have better opportunities of profiting by the war than any others, for they all have some members of their engineering staffs with the convoys or in the repair shops at the front, and these men are sending back detailed technical reports of their own and every other make of automobile. It is obvious that these reports must be more valuable than those obtained by foreign firms which only send an occasional representative or inspector to the scene of operations.

Some of the Lessons

The type of truck which the war has shown to be most suitable is the 3-tonner. Above this weight trucks are too heavy and too big for general conditions; below that weight they are too small and are liable to be overloaded. The war has shown the necessity for uniform platform heights, so as to facilitate loading and unloading. It is quite likely that a standard height will be agreed upon in each country, so as to accord with the height of railroad trucks and loading platforms.

Even now radiators are not given sufficient protection for war service. The substantial buffer uniting the ends of the frame members, as on the Packard truck, is considered insufficient by the French, and is supplemented by bars to the full height of the radiator. Bars attached to the radiator, as on some of the London buses, are also inadequate.



Upper picture—An overturned Fiat machine being inspected by French officers. The military rules require that a report of every accident be handed to the authorities who control the motor equipage of the armies

Lower picture—Cows towed the machines of the German army in Serbia across mires, in the land where good roads are the exception. The photograph might be mistaken for a scene in times of peace but for the uniforms of the officers and chauffeurs



Reo Engineer Predicts Normal Gasoline Prices After War

Horace T. Thomas Disputes Those Who Foresee a Climbing Market—
A Useless Scare, He Declares

LANSING, Mich., March 24—Among those who have given special attention to the gasoline question is Chief Engineer Horace T. Thomas, of the Reo Motor Car Co. Before going into the details, Mr. Thomas says that the word war sums up the reason why gasoline is said to be high, while the word peace covers the reason why he believes gasoline will be cheap again, or at least near its former normal price.

"If the prevailing conditions were better known," says Mr. Thomas, "there would be a good deal less said about gasoline prices. Before the war the European fields in Russia, Roumania and Galicia were as active as our own fields here in America. Now, they are inactive and we are supplying the whole world with gasoline, in addition to other petroleum products. An instance of what this export business in oil means might be gained from the fact that a few days ago twelve of those big tank steamers—which carry only oil—cleared in one day. And others are going almost daily to Europe. Thirty new steamers, much larger than those now in use, are being built under rush contracts for the Standard Oil Co.

War Means Waste of Fuel

"As for the consumption of gasoline in Europe now, it is almost beyond comprehension. Not only are there at least 40,000—some say over 50,000—motor trucks in use on the battle grounds, besides thousands of passenger cars and the hundreds of aeroplanes, all of which use a quantity of gas of which no one seems to have a correct idea—there is an immense quantity of gasoline wasted because the circumstances of war prevent absolutely the usual precautions against waste, such as we observe under normal conditions. There are also large quantities of gasoline taken to storage places which are often discovered by the enemy and destroyed. This fact alone would make it quite natural that the price of gasoline should be higher than it was before Europe started the war game.

"Incidentally, I have it on pretty good authority that oil producers, like men in other lines, have been quick to take advantage of the situation and to temporarily advance prices just because they could. In fact I am told that in order to uphold prices and for speculation purposes, a very large proportion of the oil wells of this country are actually plugged—they are not pumping. Nor are these wells controlled by Standard Oil. They are independent for the most part. Right now there are 300,000 barrels of crude petroleum in the big reservoirs on the hill

EDITOR'S NOTE—While many persons rise to ask how high the price of gasoline will go, whether 30 cents, 40 cents or 50 cents, and offer their various opinions, at least one man has had the courage to take issue with all the experts, refiners, jobbers and producers who have had a voice in the discussion. He declares they are fostering a high-price scare which itself is a stimulus to raise the cost of motor fuels. Toward the war, with the enormous exports of gasoline resulting from it, we should look for the explanation of the existing market level, and expect a return to normal levels when peace is restored, he believes. He is the chief engineer of the Reo Motor Car Co., Horace T. Thomas, and in the accompanying interview with a Motor Age correspondent, he sums up the conclusions he has arrived at after personally investigating the situation in the interests of his company. In the face of the almost unanimous cry of higher prices to come, those whose interests are affected by the rising cost of gasoline, either the car owner or the manufacturer, will find reason to feel encouraged by the differing views of Mr. Thomas.

at Oil City, Pa., held for \$3 per barrel. Speculators are paying that much and more. There's war brides for you!

"Of course this condition cannot last. There is evidence that it is about at an end. Producers have been taking the long prices of late at a rate that will surely readjust the matters.

"But, you say, could not the producers keep prices up by a continuation of those tactics? The answer is that in peace times, just as soon as gasoline in this country approaches 20 cents per gallon, Russian and Asiatic oils come in in floods. Oil, like water, soon finds its level—economically as well as physically.

Automatic Price Reductions

"Some will recall that just before the war broke out, people on the Pacific coast became alarmed at the soaring prices and feared they would continue. A company was financed to bring Asiatic gasoline over—and immediately thereafter Pacific coast points got the cheapest gasoline they had had for years. In short, just as soon as the price of gasoline reaches a certain level it begins to flow back, as I have described—and, to stop competition before it gets serious, refiners cut prices. That was the real reason for the price cutting at various times in the past, and not the supposed war between the oft-accused trust and independents. Only the war prevents repetition of this condition now.

"There is talk of the supply of gasoline running out. I cannot see it that way. Formerly only 7 per cent of the crude oil was available for gasoline. Today, owing to more efficient methods of distilling and

improvements to carbureters and motors 65 per cent of all crude oil is made suitable for engine consumption. I am further told that instead of a need for a kerosene carbureter there is only the need for the installation of the necessary equipment which will break up kerosene molecules into gasoline molecules, which will render all that is now sold as kerosene, available for power purposes.

"From the point of view of the car user, it may be stated that he is getting more miles per dollar today than he was getting, say three years ago, despite the difference in price, and that he is getting more miles per gallon out of the low-test fuel today than he was getting from the high-test then. The reason is naturally the improvements in carbureters, in motors and in motor car construction generally.

"Just credit against the 'temporarily high' cost of gasoline the 'permanently lower' cost of motor cars—and there is a large margin on the side of the user. For example, 4 years ago, Reo the fifth sold for \$1,395. Today the price of that model is \$875. And it is a vastly better car—because of improvements we have been able to work out in the meantime.

"I might go on indefinitely showing that the increased efficiency of passenger cars and motor trucks, due to improvement in design and manufacture, has more than kept pace with the price of, and has more than offset the difference in cost, of gasoline, and will continue to do so."

TAXIS HURT BY FUEL COST

Atlanta, Ga., March 25—The Atlanta Baggage and Cab Co. has petitioned the city council for permission to increase its rates, the reason given being that their expense for gasoline has become considerably more than formerly. The council fixes the rates the company can charge, which is true also of cabs and hacks and similar conveyances; the company asks council to permit an increase in rates of 10 cents in each zone, or circle of distances. This means an approximate increase of 40 per cent.

The ordinance committee of the council an increase of 10 cents in the first two zones and 5 cents in the other zones. No fight occurred on the proposition in committee, but it is a foregone conclusion that a fight will be precipitated in council. An increase in the prices asked by the company would mean a general jumping up of rates by the cabs, and by the ex-jitneys—which are now doing a hacking business in Atlanta.

Ford to Make Gasoline?

Special Refinery for Experiments; Dr. Rittman in Detroit to Assist with Plan

Success of Test Will be Followed by Commercial Production

WASHINGTON, D. C., March 28—Dr. W. F. Rittman, inventor of the Rittman process for cracking the heavier oils contained in petroleum to increase the gasoline yield, has gone to Detroit, Mich., accompanied by Director Joseph A. Holmes, of the bureau of mines, to assist Henry Ford in carrying out his experiments with the Rittman process. They are making the trip at the request of the motor car manufacturer.

It is reported in Washington that Ford is building a special refinery for the introduction of the process. If the experiment proves successful, it is announced that Ford will go into the manufacture of gasoline on a large scale.

Several motor car manufacturers are expected to appear before the sub-committee of the house committee on mines and mining in connection with the gasoline inquiry which congress is conducting. The sub-committee has just been appointed. Its members are Congressmen Vandyke, James and Garland. The task of this committee will be to arrange with the authors of the various resolutions relating to the gasoline investigation, that they appear before the committee and arrange, if possible, for the consideration of all the measures at once.

Would Invoke Anti-Trust Law

Another legislative attempt to find out why price of gasoline is so high is being made by Congressman Treadway, of Massachusetts, in a resolution calling upon the attorney general to furnish data to congress showing what prosecutions have been inaugurated by the department of justice against any person, firm or corporation for violation of Sherman anti-trust act and amendments thereto in relation to the production, transportation and sale of gasoline, and especially with relation to the increase in price in certain localities of the United States and the variation in price between certain sections of the United States.

In case the attorney general has not instituted prosecutions on this subject he is directed to transmit to the house his reasons for failure to bring such prosecution.

CONVENTION OF OHIO MOTORISTS

Akron, Ohio, March 25—Investigation of the soaring price of gasoline will come before the annual convention of the Ohio State Automobile Association at Akron, March 31 and April 1. Several hundred motorists from all over the state will

gather to discuss traffic, highway and general problems. Reports are expected on the several investigations of the fuel situation being made by different branches of the government, and Ohio authorities will be asked to look into the question under the Valentine act.

The report from Washington headquarters will be offered by A. G. Betchelder, chairman of the executive board of the A. A. A. John A. Wilson, Franklin, Pa., president of the national organization of motorists and cousin of President Wilson, has been invited to attend. Richard H. Lee, president of the Ohio State Association, will preside over the business sessions.

A LONG-HEADED GARAGE MAN

Thompsonville, Conn., March 26—A local garage man had an idea last fall that gasoline would be high this season. Accordingly he secured a 12,000-gallon tank and purchased a supply at 10 cents per gallon, wholesale.

ALCOHOL EXPERT TELLS POSSIBILITIES

Madison, Wis., March 25—If motor car designers will provide engines that will use denatured alcohol as a fuel without the waste and extravagance incident to its use in the present-day internal combustion engine, an unlimited supply of fuel is available from the waste products of the forests of the world, according to Howard F. Weiss, director of the United States Forest Products Laboratory, Madison, Wis. Mr. Weiss has just completed experiments extending over a period of three years and made a formal report to the federal government. The inauguration of the experiments was noted in Motor Age and The Automobile at the time.

The Madison laboratory produced 30 to 35 gallons of grain alcohol from one ton of sawdust and the cost ran between 13 and 15 cents per gallon. The alcohol was 95 per cent pure. The lumber cut annually in the United States is 40,000,000,000 feet. Using only the waste of the sawmills, it is estimated by Mr. Weiss that 500,000,000 gallons of alcohol can be manufactured each year.

"There is no question in my mind that the production of alcohol will develop into a gigantic industry," said Mr. Weiss. "The advantage in favor of alcohol for power purposes are manifold. When you take petroleum from the ground it is lost forever. Trees multiply. We now have in sight a half-billion gallons of alcohol each year, while our visible supply of gasoline is rapidly diminishing.

"You cannot run a motor car as far on a gallon of alcohol as you can on gasoline with the present type of engine, but with alterations and improvements, so that they will stand a higher explosive compression, the thermal energy of alcohol will equal that of gasoline. Alcohol is safer to handle, forms no carbon, has no smoke and it is not offensive."

Better Business Project

Chalmers Company Devises Cost Accounting System for Dealers' Benefit

Selling Motor Cars Requires Highly Practical Bookkeeping Methods

DETROIT, March 27—For the betterment of its dealers, the Chalmers Motor Co. has instituted a better business department and has promulgated an accounting and business system for dealers. The operation of the system is backed up by the Chalmers company, which proposes to stand behind it and assure its satisfactory operation.

The system comprises a complete set of forms, including such details as inventory cards, shop-work order tickets, material requisitions, ledger forms, a check register and everything required for an extensive system.

The Chalmers' system is regarded as a bright indication by those familiar with the dealer trade. Manufacturers are possessed of excellent business knowledge and facilities and are in good position to pass this information along to the dealers, who are greatly in need of it. One advantage is that the manufacturer is at all times in close touch with the dealer.

The Maxwell Motor Co., some time ago, brought out a system for its dealers, and explained its operation in a booklet. Similar action by other manufacturers is hoped for, and it has been suggested that the National Automobile Chamber of Commerce take up the question of accounting for dealers and urge its members to give more attention to this phase of business.

GASOLINE TOO COSTLY FOR BUSES

Baltimore, Md., March 25—The Maryland Motor Transportation Co., operating jitneys in this city, has applied to the Maryland public service commission for permission to abandon its franchise for the operation of motor buses. In its application the company states that it has been operating for 10 months, and has just been able to meet expenses with gasoline at its former price. With the present price of gasoline, the company states that it is impossible to operate without incurring a loss.

RITTMAN PROCESS FOR TEN REFINERS

Washington, D. C., March 25—Ten oil refining firms have been licensed by the bureau of mines to use the process invented by Dr. W. F. Rittman, of the bureau, which greatly increases the percentage of gasoline obtainable from crude oil. The concessions were granted without charge by the licensed firms if employment of the process be assigned to the secretary of the interior.

Materials Scarce and Prices High

Contracts for Steel Date Ahead to Third Quarter of 1917—Stearns Price Advanced

DETROIT, March 27—With raw materials costing more than ever before in the history of the industry, manufacturers see no hope for reduction in prices for some time to come. Enormous demand for steel and iron from all sources cause a situation that the makers here will not attempt to solve. They are going ahead and contracting for deliveries of what they will need far ahead into even the third and fourth quarters of next year. The shortage is being seriously felt by the big manufacturer and the small consumer as well—all are in the same boat.

There no longer is any tendency for purchasing departments to discount the present conditions. Several weeks ago there were a few who held the view that conditions would improve as the spring advanced, but evidently their method of figuring was all wrong, for each week sees increasingly high prices for everything that goes into a car.

Nor is there any hope that with the cessation of hostilities abroad there will be any betterment of prices. On the contrary, all now believe that with a great foreign demand opening up when industries of Europe again take up peaceful pursuits, the exportation of iron and steel and other materials will be enormous for the next 2 or 3 years, at least, and that any hoped-for lessening of prices on the declaration of peace is a forlorn affair.

Placing Future Contracts

Some very telling arguments are advanced by F. E. Watts, chief engineer of the Hupp Motor Car Co., who believes, with most others, that we are in for high prices for some time to come. He says in part:

"At the present time, the steel companies are contracting for the third and fourth quarters of this year at the present market prices, which are high. In order to protect themselves on the raw material, the steel companies are now contracting for their pig iron, coke, steel scrap and alloying elements, the prices of which are extremely high. Practically all of the ferro-manganese used in the manufacture of steel is imported from England. The latest quotation made on this product was \$225 per ton, in comparison with \$40 per ton before the war started. The last week the British government declared an embargo on the exportation of ferro-manganese, and it will have to be obtained from some source, as yet undeveloped.

"The railroad companies are ordering very heavily to keep their rolling stock and rails in condition. In the first 2 months of this year 641 locomotives were ordered, approximately 10,000 freight cars of various types, and the rail tonnage will be over 150,000 tons.

"The Russian government last week contracted for 60,000 tons of rails. The locomotives will have the tendency to keep the price of tubing up, as there are thousands of feet of this material used in every locomotive.

"The shipbuilding companies are busier than at any previous time, and the contracts held by the American shipyards will keep them busy throughout 1916, part of 1917, and some boats are being contracted for with delivery specified in 1918. The engines in these boats also will require an immense amount of tubing, and the decks and plates for the hulls will require a large tonnage of cheap steel.

No Steel from Europe

"At the present time there is very little steel being produced in Europe, and with the destruction of railroads and railroad equipment, and bridges, there is going to be an immense demand for steel after peace is declared. Steel men estimate that the exportation will be very large for at least 2 or 3 years after the war is over.

"One of the minor reasons for the high price of crucible steels is the lack of pure graphite for crucibles and the increase in price of the crucibles now in stock. In one or two cases steel mills have had to shut down their crucible plants until such time as they can get more crucibles.

"The steel mills are all expanding as rapidly as possible, but it will be several months before the additions will be in condition to make any appreciable effect upon the supply of steel.

"We cannot possibly escape the effects of this general increase. What we gain in one place by purchasing, manufacturing, or designing skill, or by getting parts from companies which have raw materials in stock, we lose elsewhere. Many of our gains are temporary, while our losses are permanent. Nor does there seem to be any relief in sight. At the present time it is impossible to tell what the outcome will be."

The Findeisen & Kropf Mfg. Co., Chicago, maker of the Rayfield carbureter, has been experiencing record breaking sales within the last few months, which it ascribes not only to the merits of its carbureter, but also to the rise in the price of gasoline. The high price of gasoline has pushed sales to the limit, but the Rayfield people say that, owning their own smelter and foundry, with their own tool and pattern departments, they are well fortified against shortage of materials.

Stearns-Knight Advance in Price

Cleveland, O., March 24—The F. B. Stearns Co., builder of Stearns-Knight motor cars, announces an advance of \$50 per car on all models, beginning March 20.

"The cost of raw materials has ad-

vanced so rapidly and steadily," said Frank B. Stearns, president of the company, "that in order to meet the prevailing high prices of materials necessary to the quality and standard of Stearns-Knight construction, we are compelled to increase the selling price."

Stearns' production since the first of the year has already passed the mark set by the entire output of the previous year. And, while the increase in production lowered the price of the Stearns-Knight at the beginning of the present season, the increase in the cost of materials has gradually passed the point which made possible this lowered price and forced the advance in the selling price.

Apperson Brothers, Kokomo, Ind., are sending out the announcement that there will not be any increase in list prices on current models.

The prices they placed on 1916 cars at the beginning will remain until the 1917 models are announced. They are willing to shoulder the burden of the extra cost rather than to disarrange the dealers selling campaign and embarrass their sales organization in any way.

MOTOR EFFICIENCY SUBJECT

Indianapolis, Ind., March 27—How to increase the thermal efficiency of the motor car in order that the gasoline consumption shall not remain an acute problem will be discussed by C. E. Sargent, chief engineer of the Lyon-Atlas Co., in the paper which he will read before the Indiana section of the Society of Automobile Engineers, March 31. He will present a plan by which it is declared possible for motor car designers and manufacturers effectively to combat the rise in gasoline prices.

ELECTRIC VEHICLES THEIR TOPIC

Chicago, March 28—The esthetic in the designs of motor vehicles, both in electrics and gasoline-driven cars, plays a more important part in selling machines than the average manufacturer or dealer realizes, and is the real reason for others of us buying motor cars, according to Gail Reed, of the Walker Vehicle Co. In a paper on "The Accomplishments of the Electric Passenger Car," read before a meeting of engineers at the rooms of the Western Society of Engineers, March 27, he told his hearers that the basic value of the esthetic in motor vehicles, as a commercial proposition, cannot be computed and is commonly under-estimated.

A joint meeting of the Western Society of Engineers, the Electric Vehicle Association, Chicago section, and the American Institute of Electrical Engineers was the occasion. The development of the electric motor from the time of the first electric vehicles to the present was illustrated graphically in stereopticon slides by F. A. Putt, of the General Electric Co., who traced the gradual improvement in efficiency and described the changes in design

necessary to evolve a highly efficient motor of the present-day pattern.

A paper was read by W. F. Hebard, of the Buda Co., on "Storage Battery Industrial Trucks and Tractors." The industrial truck and tractor for inter-department haulage in factories, baggage removal in railroad stations and for similar service elsewhere, was discussed.

STOVER TRACTORS IN FIELD

Freeport, Ill., March 25—The first model of the new Stover tractor was turned out this week in charge of the designer, W. F. Freidag, superintendent of the Stover Engine Works which is to manufacture the machines. The wheelbase is 90 inches; the front wheels are 36 inches in diameter and the rear drive wheels, 56 inches.

The motor has four cylinders and is rated at 40 horsepower. The tractor is to be sold as three-plow machine, but has a capacity for four. A Bennett carbureter and air cleaner is part of the equipment. The Stover company plans to turn out 100 or more of these machines during the coming season and work will commence as soon as the tests of the first model have been completed.

FORM A TRACTOR SHOW CIRCUIT

Omaha, Neb., March 24—A tractor show circuit embracing some seven or eight cities of the best agricultural sections of the Northwest has been definitely decided upon, and plans are rapidly nearing completion. The newly formed circuit will be under the charge of A. E. Hildebrand of Omaha.

Nearly 50,000 people attended the tractor demonstrations held in Fremont, Neb., last year, and this city will probably be one of the first places selected for one of the exhibitions. One state east of the Missouri river will be included in the circuit, and as this is most likely to be Iowa, the cities of Des Moines, Iowa and Cedar Rapids, Iowa, are bidders for the show.

ADD POLISH AS EQUIPMENT

Detroit, Mich., March 24—Every season sees the regular equipment of motor cars added to and the latest is the announcement that Chalmers, Maxwell, Winton, Chevrolet, Paige, Oldsmobile, Reo, Buick, Detroit Electric, Grant, Mitchell and Hupmobile will add to the toll kit a regular can of O-So-Ezy polish.

A number of manufacturers have made tests and experiments with polishes. One leading manufacturer some months ago tried out the O-So-Ezy polish, which is made in Detroit by the O-So-Ezy Co., and which has been on the market several years as a furniture polish. The results were so successful that this manufacturer instructed all its service stations to use nothing but this polish on cars and out of this incident grew an arrangement whereby this company was to supply a can of the polish with each car.

S. A. E. Standard in Tractor Engines

National Gas Engine Association Favors Adopting Specifications of Motor Car Engineers

CHICAGO, March 25—S. A. E. standards probably will be adopted for tractors. The importance of the tractor industry has been recognized by the National Gas Engine Association by its formation of a tractor section of the Standards committee of that body. This section had its first meeting at the Sherman House here today and recommended a number of standard specifications for tractor engine accessories, measurements and dimensions, most of which were based on S. A. E. standards.

Among the points discussed for standardization were magneto mounting dimensions, and couplings, spark plugs, screw threads, tap and die limits, carbureter fittings, fan belt speed, clutch-pulley spiders, and horsepower rating. The only peculiar tractor feature taken up was that of drawbars for wagons and other trailers.

As this was the first regular meeting of the Tractor section no definite recommendations were made of standards, in most instances, as it was felt that in the majority of cases further study was required before a recommendation could be made. However, a standard spark plug was recommended to the association as a whole for adoption for all gas engines, not tractor engines alone. This is a $\frac{7}{8}$ -inch plug, with 18 pitch, and this standard was adopted chiefly because it is the standard plug adopted by the Society of Automobile Engineers.

Figure on Export Trade

The export trade in tractor engines which is anticipated necessitated the consideration of whether or not the plug adopted should be of metric threads instead of U. S. standard, and a very lively discussion arose on this score. The suggestion that arrangements be made by which spark plugs of any pitch thread and of any diameter under a pre-determined maximum could be used. This, it was suggested, could be accomplished by making the spark plug hole considerably larger than the $\frac{7}{8}$ -inch, and put in a bushing which, in America, could take a $\frac{7}{8}$ or $\frac{1}{2}$ -inch U. S. standard thread plug, and for foreign use it would be necessary only to change the bushing for one which would take a metric plug. The discussion of this subject brought up a number of interesting points.

George A. Schwer, of the Danah Mfg. Co., Sandusky, O., insisted that a bushing of liberal diameter be used as the original suggestion of a shell which replaced the $\frac{7}{8}$ -inch plug and the $\frac{1}{2}$ -inch plug would not be safe, as it could not stand up. Then, Charles Kratch, of the gas engine department of Montgomery Ward & Co., suggested that all holes be tapped for

bushings, so that any plugs to answer the foreign or domestic be used. S. W. Walker, Sumter Electric Co., suggested that inasmuch as the trade would be called upon to supply large quantities of engines for foreign shipment, it should be prepared to meet this demand as well, and that the bushing should have a metric thread, which he believed was the U. S. government as well as the foreign standard.

Fred Glover, of the Emerson Brantingham Co., Rockford, Ill., voiced an opinion which was quite general that the idea of putting in a bushing in every engine in order to take care of the comparatively small proportion of the output for foreign trade would be uneconomical. Further, that the use of a bushing would put the plugs too far away from the water space. H. T. Buffington, of the Minneapolis Steel Machinery Co., concurred in this, and stated that where metric threads were needed it would not be difficult to tap out the holes for them. The bushing idea finally was dropped, and the S. A. E. standard plug recommended.

Magneto Standards

For standard magneto dimensions the S. A. E. standards were recommended for adoption. However, it was felt that there was one feature in tractor practice which was not cared for by the S. A. E. standards and this was the case of the impulse starter, which has been developed for use in tractor engines. There are four or five magneto concerns offering these impulse starters and all of them differ from $\frac{1}{8}$ to $\frac{3}{4}$ inch in the dimension from the first holes in the base to the face of the coupling, and it also was brought out that the length of magneto shaft end to the first holes in the base varied among the magneto makers.

This brought up the point of magneto couplings, which was discussed by F. B. Williams, Sumter Electric Co., and who developed the conditions necessary for flexible couplings for tractor magneto drive, and illustrated with samples of a number of different types. The question of the standardization of couplings was referred back to a sub-committee for a later report.

The standards of the Society of Automobile Engineers used as a basis to a great extent the discussion of the standards for tractors, and this section of the standards committee of the N. G. E. A. realized the value of working in harmony with the S. A. E. By special request, the Standards committee of the Society of Automobile Engineers was represented by E. H. Ehrman, of the Chicago Screw Co. There were twenty-five representatives of the tractor and allied interests present.

Grand Prix Delages Brought to America for Campaign

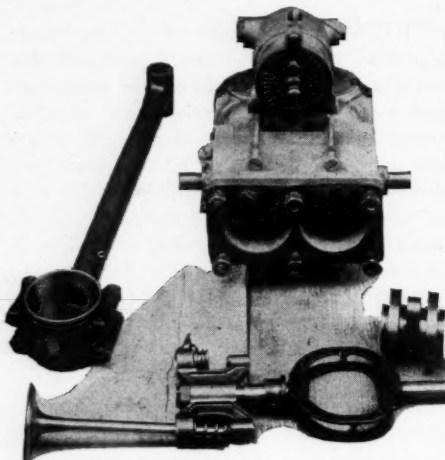
Strong Competition Expected in Season's Events—Harry Harkness, Importer—Carl Limberg to Manage Team This Year

NEW YORK, March 27—The three Delage cars which took part in the last French grand prix are now in New York, and will make their appearance on the speedways very shortly. These cars have been imported by Harry Harkness, and will be managed by Carl Limberg, who will drive one of them. Drivers for the other two are not yet picked.

At the time of their first appearance, these cars were wrapped in much mystery, their details being kept very secret. Gradually it leaked out that their especial novelty was a set of sixteen poppet valves, each of which was both shut as well as opened by a cam, the spring forming only a cushion. Exactly how this was done has never been allowed to escape, though some diagrams were obtained showing the principle. One of these was published last year, and the photograph of the actual parts on this page shows that the actual pieces are very much like the diagram. There are three cams to each pair of valves, the midmost lifts the valve by pushing down a stirrup that surrounds the cam, and the two outside cams bear upon the side pieces of the stirrup and pull the valves shut, acting through two springs.

Sets a Pace

In the practice spins before the race Bablot, who had one of the trio, astonished the fans by making a lap in minutes less than most of the others, and from that time onward the Delage team was reckoned to be about the fastest in the field. On the race day, however, some petty maladjustment of the carbureters made at the last moment upset all calculations, and the Delages did little to justify the high hopes of their backers.



Details of the valve gear, the cylinders and hollow connecting rod

Still everyone recognized that it was an accident, and that it was no fundamental fault that had caused the trouble. Since July 4, 1914, the speed machines have been resting under a coat of oil. They are essentially as good as the day they left the factory; they are more nearly new than any European car in America today. Thus it is reasonable to expect great things of the team.

The photographs herewith show more detail of the cars than has so far been published. It will be seen that the two camshafts are driven by a single vertical shaft with a nest of bevel gears at the upper end, the spark plugs being in the center of the cylinder heads. A small peculiarity is that the cylinders are bolted on from beneath the studs fitting in the cast iron foot with the nuts inside the aluminum crankcase. The valve mechanism

is shown just beneath the cylinder has the stirrup turned at right angles to its proper position so as to show the whole part in one photograph. There are two Claudel carbureters on each engine, operating simultaneously with throttles interconnected.

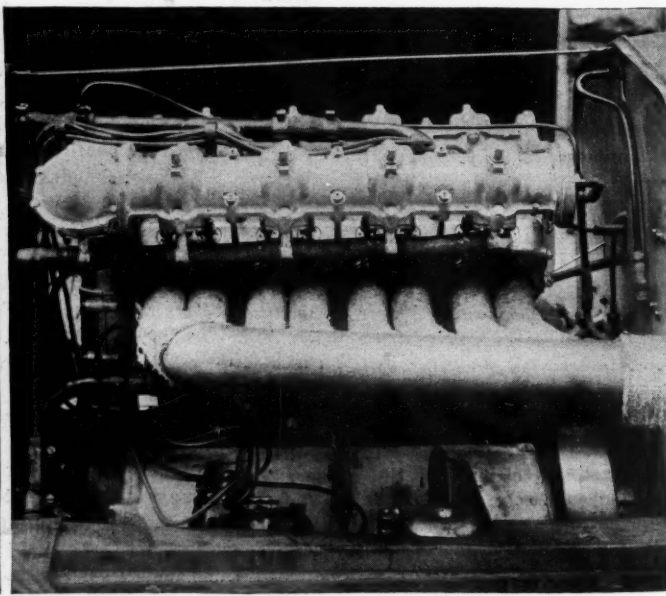
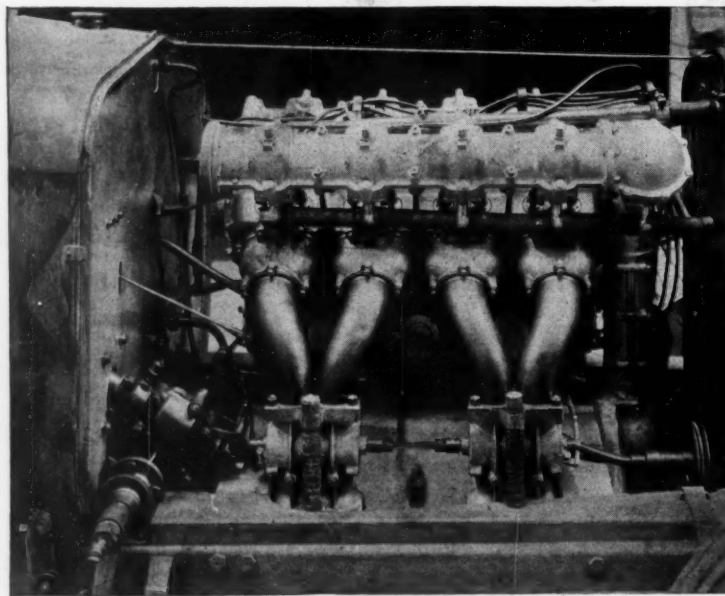
Because of the very hilly nature of the last grand prix circuit in France five speeds are provided with direct on third, and the nature of the road also dictated the use of the large front wheel brakes. In addition to these there are a pair of brakes on the rear wheels and a transmission brake as well.

The engines are well within the 300 cubic inch limitation, being 94 by 160 millimeters, or 3.7 by 6.3 inches. This gives a piston displacement of almost exactly 270 cubic inches. The wheelbase is 106 inches, and the tires 34 in diameter on Rudge-Whitworth wheels.

Not Much Bodies

At present the bodies are little more than seats, as the many curves of the French course made the value of streamline tails quite doubtful. Just back of the seats there is an immense tank for gasoline and oil, the latter being fed by hand pump when desired, and circulated in the engine by a centrifugal system. It is planned to inclose this tank, and to provide each car with a body more suited for speedway racing.

Being more nearly new, the Delage team ought to prove much more formidable than did the Peugeot team last year, as in the latter the only really new car was Resta's, the others being already well worn. It is unquestionable that the presence of this new trio will make a substantial differ-



Left and right sides of the Delage engine, giving a good idea of the valve mechanism

ence to the keenness of competition on the speedways this coming racing season.

From an engineering viewpoint it will be very interesting to see how the latest Delage engines stand up to the strenuous requirements of speedway competition. Originally these cars were designed for road racing on a course where gears were shifted almost every quarter of a mile for a third of the circuit, but there was one very long straight, over eight miles, where speeds of 110 miles and over could be attained. There was a long hill, where the

engines could revolve at their maximum speed on the lower gears, but there was a descent giving quite a respectable rest to the motors at the end of the long straight.

On the speedway where there is no rest period the conditions are more difficult for engine durability, but since the Peugeot engines proved equal to the stress, there is every reason to expect a corresponding performance from the Delage cars, and these machines were undoubtedly faster than the 1914 Peugeot when opened out to the full.

him several times on the curves. It was a race full of thrills and on every turn thousands of spectators held their breath, expecting to see one or more of the drivers pile up against the curb or turn over against the high banks of baled hay, but outside of the spill mentioned, no further mixups occurred.

PACKARD EMPLOYES PATRIOTIC

Detroit, Mich., March 24—Several hundred red, white and blue buttons bearing the legend, "Americans First," are to be seen about the factory of the Packard Motor Car Co.

Since the announcement was made of the Packard policy of encouraging aliens to take out citizenship papers, novelty manufacturers have taken advantage of the popularity of the idea. One concern has disposed of about 2,000 of these buttons at various plants in Detroit. The Board of Commerce has arranged to have citizenship classes in about a dozen schools in various parts of Detroit. Two of these are near the Packard plant.

Merton A. Sturges, chief naturalization examiner of the United States government, visited the Packard factory March 20 and made an address to employees, particularly those who have filed their declaration of intention papers.

Burman Wins San Diego Cup

Tetzlaff Second in First Boulevard Event Held at Exposition on 50-Mile Course

EXPOSITION GROUNDS, San Diego, Cal., March 25—Bob Burman in the French Peugeot won the freakiest race of his career today when he captured the Exposition cup event before a crowd estimated at 38,000.

The race on the exposition grounds this afternoon was the first boulevard contest ever run under the sanction of the A. A. A. and it probably will be recognized as a world's boulevard race record, at least until the Corona classic is run, April 8.

Considering the nature of the course, the time made was remarkable. The times for the first three to finish were as follows:

Car	Driver	Time	M.P.H.
Peugeot.....	Burman	57:34.8	52.14
Milac.....	Tetzlaff	58:20.4	51.42
Delage.....	Oldfield	59:15	50.58

Cliff Durant, in the Durant Special, crossed the line after driving 1 hour $\frac{2}{3}$ seconds.

Arrangements Were Novel

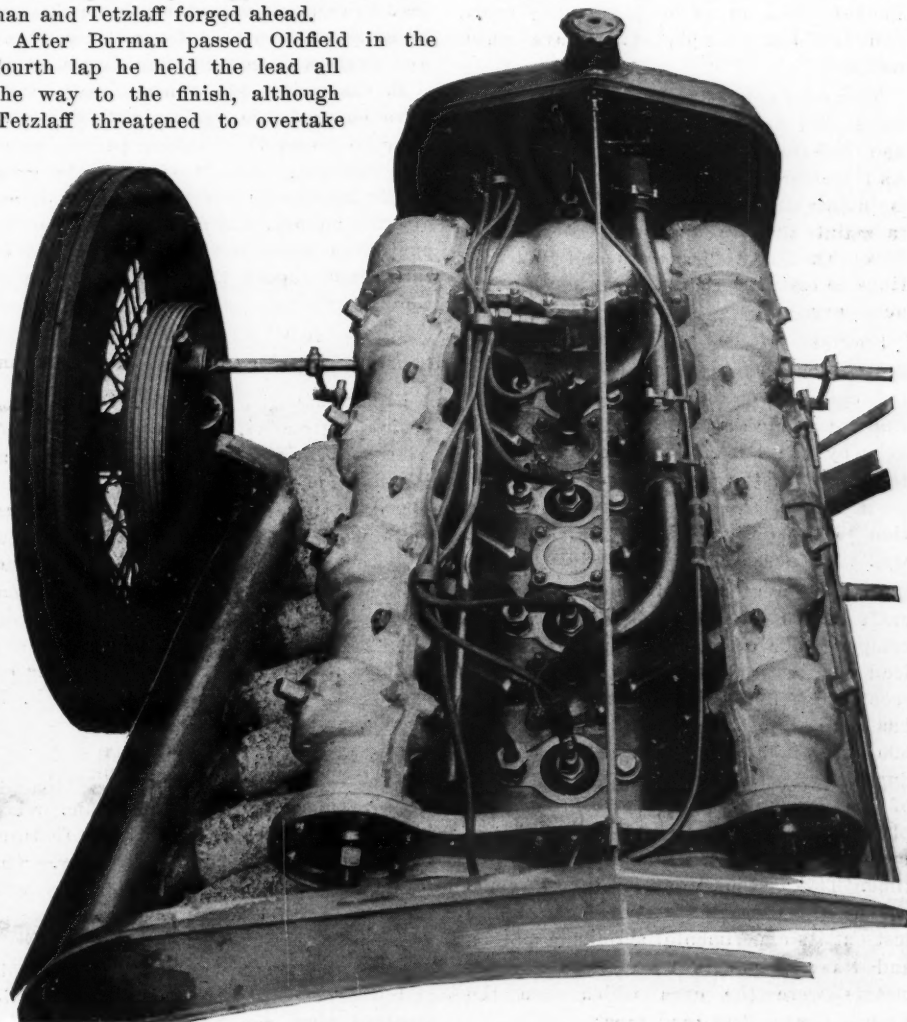
The arrangements for the race were as novel as the course was freaky. The home of Bosco the snake eater was used as the judges' stand. The pits were located in an animal cage vacated for the afternoon on account of the races and the official grandstand consisted of several hundred benches placed on the main street of Grizzly Gulch, the famous '49 camp.

On account of the many turns and the narrowness of the course, only four cars were allowed to start. On the opening lap, Durant, Tetzlaff and Burman overran a turn and tangled up in the safety zone. Durant's car suffered the most damage. He broke several spokes out of a rear wheel and bent his frame, but after changing the wheel and incidentally losing two laps, he continued in the race and made up a lap before the end of the 50 miles. Spectacular driving, even though no remarkable speed was made, marked the race from start to finish. Spectators were given plenty of thrills all through the race.

Oldfield jumped out in the lead in the first lap and while the drivers were getting back on the course after the near-disastrous affair on the curve, Barney stepped half a lap to the good on Burman and

Tetzlaff. On the third lap Barney jarred his oil line loose and for the rest of the race he and his mechanic had to ride through a spray of lubricating fluid. The leaky oil line spoiled Barney's chances for first money, and had not Durant lost two entire laps, Barney would have been the last to get to the checkered flag. He knew that he could not stop and repair the damage without losing at least two laps and therefore kept up at the best speed possible and gradually dropped back as Burman and Tetzlaff forged ahead.

After Burman passed Oldfield in the fourth lap he held the lead all the way to the finish, although Tetzlaff threatened to overtake



Top view of the Delage motor and one wheel showing brake mechanism in front



Packards Not in Racing Game

Vincent Refutes Rumors that Company Intends to Compete Exhibition Speedwork on Factory Program

DETROIT, March 24—That the Packard Motor Car Co. has no intention to speedway contests as a sport or spectacle is stated by J. G. Vincent, vice-president of engineering of the company. Rumors had been going about lately that Packard was to enter the racing sport, and this has prompted the above statement.

This does not mean, however, that speed trials and tests having an experimental and research meaning will not be held. As a matter of fact, the Packard company is maintaining its own experimental garages at the Indianapolis, Chicago and Sheepshead Bay speedways and will continue to test its motors there when thought necessary.

Speedways, according to Mr. Vincent, are the only places available for subjecting cars to rigorous tests of continuous running at high speed. Furthermore, it is held by the Packard engineer that such tests lead to the gathering of highly important information having a direct relation to the design of cars which cannot well be otherwise obtained.

Two different twin-six motors for aircraft have been designed by the Packard company, one of a maximum capacity for load carriers and a much smaller one for scout work and private use. The latter has a total piston displacement of about 300 cubic inches, and in order to test its durability, Mr. Vincent states that some of these small aircraft motors will be placed in racing type chassis to be driven by him at high speed for a long period of time. This method was used several years ago by the German Mercedes company to test out its experimental aeroplane motors, and its racing cars with these aircraft motors were the ones which won the French Grand Prix road race.

Thorough comparisons will be made between the performance of the twin six aircraft motor and that of all available types of high-efficiency motors which have been especially developed for speedway or aircraft work. It is expected that this will lead to securing valuable data on the comparative efficiency of fours, sixes, eights and twelves of equal piston displacement.

In conclusion, Mr. Vincent says: "We have no prejudice against racing, but we have no intention of taking part in speedway contests. But in view of the great public interest in the performance of our aircraft motors, it is entirely possible that exhibition speed work will be carried on this season under the A. A. A. supervision."

BIRMINGHAM TRACK ENCIRCLES LAKE

Birmingham, Ala., March 25—Work will be in progress within a week on the 2½-mile speedway which is to be built at Birmingham by the Birmingham Motor Speedway Co. Contracts were signed last week with Hinkel & Sullivan, Cincinnati, O., the stipulated expenditure being \$500,000. The plans and specifications, herewith reproduced, were furnished by McCarthy & Maddox, motor speedway builders and underwriters, through the co-operation of H. B. Wheelock and R. L. Totten, architects.

The course will be 100 feet wide and built of reinforced concrete and steel. The track will be topped with bitulithic. When built, the course will include features found in no other motor speedway. The track proper will be 40 feet wide with 30 feet of turf on either side, which will afford a zone of safety.

The grandstands will seat 50,000 people and will be constructed so that an unobstructed view can be had of the entire

course. The site encircles the lake of the Birmingham Motor and Country Club. Numerous exits and gates leading to wide boulevards will assure the handling of the crowds with ease.

The first race will, in all probability, be held in the early fall and will be of international interest.

PATTERSON HEADS C. A. C. AMATEURS

Chicago, March 27—E. C. Patterson, former backer of Ralph de Palma, has been elected captain of the Chicago Automobile Club team for the invitation non-professional driver's race at the Chicago speedway, May 20. It is expected that there will be a large entry list from the local motoring organizations as well as from other clubs in the vicinity. The Rotary Club has named five entrants, and a number of the Chicago sportsmen were out for unofficial practice Saturday. Arrangements were made for official practice Sunday, but weather conditions did not permit it.

It is worthy of remark that the official practice the Sunday before was the first time in America in which amateur drivers have ever figured in practice under official supervision for a speed meet.

ANDERSON MAY BE INDEPENDENT

Indianapolis, Ind., March 24—Gil Anderson, champion speedway driver, probably will be the manager of the new Stutz team of racing cars for the 1916 season. It is reported that Anderson is negotiating with Harry Stutz for the use of the three white cars which he managed last year. Whether or not the withdrawal of Stutz from racing last year will prevent the use of the cars under independent management has not been determined.

Of the four Stutz cars in the team last year, one is now being raced in California

by Earl Cooper. Anderson hopes to take the other three, in which case Tom Rooney will be a second driver; the third has not as yet been decided upon.

WANT RICKENBACHER ON COAST

Chicago, March 27—Eddie Rickenbacher, manager of the Prest-O-Lite racing team, may be a contender in the Corona meet, April 8, and in the Ascot meet, April 16. In a letter to Motor Age, Rickenbacher states he has been offered the Bentel Mercer for both events, and has been informed by George Bentel that the car is in perfect shape.

Rickenbacher states that he will accept the offer if his work at Indianapolis will permit it.

MOTOR-WISE POLICEMEN

St. Paul, Minn., March 25—It is dangerous to try to run by a policeman and not expect him to be able to estimate the speed of your motor car. The St. Paul cops know motor car secrets well. One of them buys old cars, repairs them and sells them again at a profit. A detective has a taxicab in service and coins additional money that way. Sixteen policemen own cars and take their families out for airing in their own machines. Three central-station patrol and ambulance drivers have purchased cars. The two police surgeons defy fate by chauffeuring their own cars also.

Foreign Cars for American Races

Europe's Speed Masters Turn Attention to U. S. and Will Compete in Big Events

PARIS, March 11—America will probably see some European talent in its big track races this year. It is almost certain that Rene Thomas, winner of the 1914 race at Indianapolis, will cross the Atlantic to take the wheel of one of the Peugeot cars bought by the Indianapolis Speedway Co. last year. Thomas, who is free from all military obligations, contemplates sailing at the end of March.

Around the Brooklands track it is an open secret that the Sunbeam Co. has built two six-cylinder, 300-cubic-inch racing cars specially designed for American track conditions. The military authorities of England have given permission for one of these cars to be exported, and arrangements are well in hand for Joseph Christiaens to handle it in some of the leading American races. The new Sunbeam is a four-valve motor in which has been incorporated all the experience gained during recent months in the building of aviation engines. In trial work the car has shown a speed of 120 miles an hour. The acceleration is remarkably rapid, it being possible to get the motor to its most efficient speed of 3,000 revolutions a minute on one of the straightaways of Brooklands, standing start. Joseph Christiaens, who has been selected as driver of this car, is the Belgian who drove the six-cylinder Excelsior into sixth place at Indianapolis 2 years ago.

Fiat is showing interest in racing, and although no decision has yet been arrived at regarding an American campaign, two

cars are in preparation at the Turin factory. These are the 1914 Grand Prix models with engines re-designed with four valves, and increased in bore so as to bring the cubical capacity to the maximum of 300 inches. The engines have undergone thorough bench tests and are declared to be quite satisfactory. Drivers selected for these cars are Jack Scales and Antonio Fagnano. Scales is an Englishman on the testing staff of the Fiat company at Turin, and was driver of one of these cars in the last French Grand Prix at Lyons. Fagnano is one of the old school of drivers. He acted as mechanic to Felice Nazzaro during the period when the Italian crack got away with all the leading prizes in Europe. Both Fiat men are spectacular drivers of the dashing type typified by Lancia. No statement will be made by the Fiat company regarding their rumored participation in the races. It is understood from reliable sources that the cars will only be sent if they prove thoroughly satisfactory in their trials.

ENTER CARS IN MAY 23 EVENT

New York, March 28—Special telegram—Ralph Mulford has entered a Peugeot for the 150-mile Metropolitan trophy race at Sheepshead Bay speedway, May 23. Three Crawford Specials also have been entered. These cars are equipped with 16-valve Duesenberg four-cylinder motors, each having a bore of 3¼ inches and a stroke of 6¼ inches.



Attractive decorations at the motor show at Trenton, N. J., a most successful exhibition

Are You Familiar with the Causes of Misfiring?

Hints By Which the Owner-Driver May Locate Trouble

THE motor car engine has been developed to such an extent that mechanical knowledge of the owner-driver and chauffeur can be very limited and still be enough to keep the car tuned up and out of the repair shop. However, if engine trouble is not traced systemically, amateur tinkering will oftentimes lead to more serious troubles and complications. In this case, the driver would have been better off had he put the car in the hands of a competent mechanic in the first place.

On the other hand, though, it is unnecessary to have a car towed home with nothing really serious the matter with it, or to have the car laid up for a few days on account of a defective spark plug or two. This article is intended to throw some light on the subject of misfires, and to enable the average man to locate the cause of some common troubles himself. As a rule, he is too much at the mercy of the garage or service man.

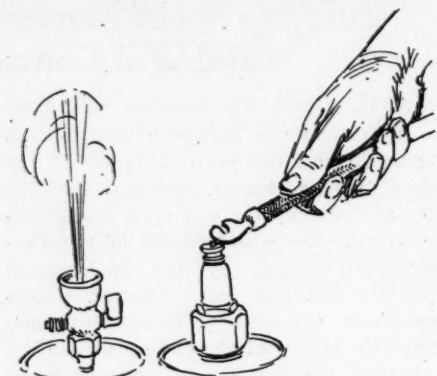
Assume that your car refuses to start as it has always been in the habit of doing, although you have made sure that the switch key is in place, that there is gasoline in the tank and everything is apparently the same as usual. The main thing to remember is to keep cool, no matter how out of wind you are, for if you lose your reasoning power you are helpless. A motor car is unlike a balky mule in that it can be reasoned with and it is up to you to calmly reason out why it refuses to start.

Why Motor Does Not Start

If you have tried cranking it over a number of times, the chances are good that the cylinders are either perfectly dry or full of raw gasoline. We will start with the assumption that the latter is the case, which would mean that the spark plugs are shorted with gasoline liquid.

Open the petcocks on the cylinder heads, or, better yet, remove the spark plugs and crank the engine over about twenty times by hand. It is advisable to open the throttle and also have someone hold the air valve of the carburetor open so only air will be drawn into the combustion chamber. Now set your spark and gas lever in the usual places and close the petcocks.

If the engine does not start now, pour about a thimbleful of gasoline in each cylinder. A handy thing to have for this purpose is a small bottle which can be lowered into the gasoline tank with a string and fresh gasoline from the top of the supply can be obtained. Then, upon cranking the engine not more than a few revolutions, one of the following conditions will arise:



If the sound is not changed by disconnecting the wire to that cylinder, that particular one is misfiring

By O. H. Goetz

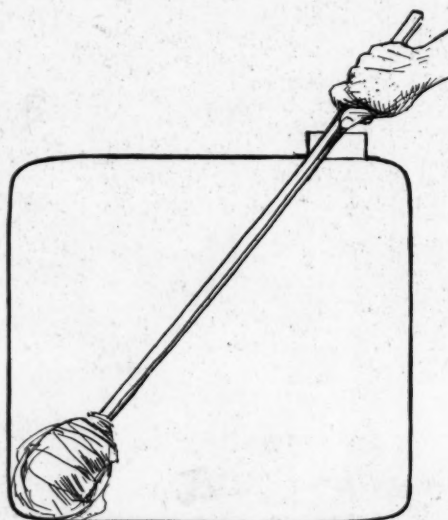
- 1—Engine will start and keep going.
- 2—Engine will give a few explosions and stop.
- 3—Engine still refuses to start.

Engine Starts and Keeps Going

If you can get started in this way, all well and good, but it is probable that it has been necessary to prime the engine many times before, especially in cold weather. Priming, when it necessitates reaching under the hood with your best clothes on is disagreeable, to say the least. It being impossible to get a higher grade of gasoline, I think that anything which can be done to eliminate priming will be worth while.

A primer pump installed on the dash board is satisfactory, but even then, it takes practice to know just how much to pump and then to know just how to manipulate the carburetor controls in order to not flood the engine with too much gasoline.

Any air drawn into the cylinders except through the carburetor will cut down the suction to such an extent that starting may be seriously affected. If the engine



The tank should be drained dry and the bottom swabbed with a rag wrapped around a stick. Never use waste

How to Remedy Difficulties and Aid Cylinders That Miss

will not idle down slow it is a good sign of an air leak, and all manifold gaskets, cylinder head gaskets and intake valve guides should be tested for looseness with gasoline.

In regard to the spark, it is self evident that a hotter spark for starting will help matters, so, as it is possible that the magnets of the magneto may be weak or that the coil may be shorted, an inspection by the ignition service man may solve the question.

Engine Gives a Few Explosions and Stops

Considering the second case, in which the engine stops after giving a few explosions, if you get the same result repeatedly and are reasonably sure that you strangle the carburetor correctly you are safe in concluding that the trouble lies in the gasoline supply pipe. Now as a restriction can be anywhere between the tank and the manifold, start with a system and disconnect the union between the gasoline pipe and the carburetor. If the gasoline does not flow out of the pipe or comes out in a small or intermittent stream, the pipe should be disconnected from the tank, examined for kinks and blown out. If water or dirt is found, it is a good indication that there is still some more in the tank itself, which in time also will work its way into the line. So, to make a permanent job, the tank should be drained dry and the bottom swabbed with a rag wrapped around a stick. Never use waste.

If a good sized stream issues from the pipe, the carburetor needs looking after. Most carburetors have a strainer which can be removed, and if the restriction is not found here, the carburetor will have to be taken apart and thoroughly cleaned and inspected. Care must be taken that the same adjustment is put on it again.

Engine Still Refuses to Start

This last case is undoubtedly due to spark failure, and it can be easily checked up by separating the connection at the plug a distance about the thickness of a calling card. The wire may be held this distance away by hand while someone else cranks the engine, but care should be taken or you will receive a shock. The spark plugs should be inspected and probably set a trifle closer.

If no spark is noticeable, the trouble in most cases will be found somewhere in the low-tension wiring. If you have a magneto, examine the ground wire leading from the magneto to the switch on the dash. Remove the interrupter housing cover and see if the mechanism is work-

ing freely, and that the platinum points separate.

It may be necessary to use a small looking-glass to see this work. If you start on the magneto advance the spark a little more and try to crank it faster. If you are starting on the battery, make sure that it is not dead.

In the case of a battery system, the trouble most likely lies in the fact that the switch key does not make a good connection. With these systems, care should be taken that the storage battery is not run down too much, for the strength of the spark depends on the strength of the storage battery.

Engine Misfiring

The driver of a motor car soon gets accustomed to the various sounds caused by his engine, whether it be only a soft purring or humming sound, or a harmonious combination of sounds from the muffler, valve tappets, magneto, timing gears, etc. As soon as this is disturbed for some reason or other, he should be aware of the fact and take steps to find the reason. Besides having an irritating effect on the nerves, it may lead to serious engine trouble.

A missing cylinder can be detected quickly by opening the cutouts, but as most cars are not equipped with muffler cutouts, the driver must rely on the slight sound from his muffler, and in most cases it can be felt in the running of the car. Of course, the first thing to do is to locate the cylinder or cylinders misfiring, and the rest is comparatively easy.

There are various ways of going about this, but I think the easiest and most positive method is to loosen all the wires on the spark plugs so that they can be easily disconnected or connected while the engine is running. Idle the engine and open a petcock slightly so that a plain hissing sound is heard.

If the sound is not changed by disconnecting the wire to that cylinder, that particular one is misfiring. This should be tried at a trifle faster engine speed also. In some cases it may be necessary to go through this operation on the road, having some one else drive. It may be found that the miss occurs only upon acceleration or when the engine is pulling under a brake load or up a hill. By holding the wire about $\frac{1}{8}$ inch away from the body or grounded portion of the spark plug and accelerating the motor quickly, it can be settled once for all whether the ignition is at fault or not.

In most cases, the spark plug will be found covered with oil and soot and should be cleaned thoroughly and examined for a defect. If no crack is found in the porcelain, the trouble did not originally come from the plug, and unless too much oil was fed, fixing up the spark plug will probably only fix matters temporarily. This plug should be exchanged with a plug from a good cylinder and the engine again checked over for a misfire.

If you find that this other cylinder is now misfiring, it is conclusive that there is a defect which you have overlooked in the plug. To prove this to your own satisfaction, put a spare plug in the cylinder and open the gap of the plug in question to at least $\frac{1}{8}$ inch. Lay or hold it on the cylinder with the ignition wire connected.

This spreading of the gap gives the same condition as there is in the cylinder, the resistance in this latter case being increased on account of the compression in the cylinder. If the spark does not jump across the gap but up in the plug somewhere, it is conclusive that it is a new plug you need.

In case the plug was found to be all right, the cylinder should be tested for compression by lifting the starting crank slowly against the compression, and comparing with the other cylinders. In most cases the missing cylinder will be found very weak in compression, and a case like this should be turned over to a mechanic. It may be a defective valve, piston ring, cylinder head gasket or a scored cylinder. A high tappet rod is a very common cause of loss of compression, the lowering of which should always be accompanied by grinding a new seat on that valve.

Weak compression and a spark plug set with too wide a gap will show up best on acceleration or climbing a hill. The

exact distance that a spark plug gap should be set depends on the type of ignition and largely upon the make of the car.

If an uneven missing occurs at low speed only it is probably due to a slight leak through a manifold gasket. Pouring a little gasoline on a leaky gasket while the engine is idling very slow will cause the engine to either speed up a trifle or stop it. Of course, an air leak due to a worn valve guide will cause only that particular cylinder to misfire.

A bad irregular misfiring which cannot be traced to any particular cylinder usually is due to badly pitted platinum points on a short circuit in the ignition system. Every battery and magneto system has a different method of adjusting the breaker points, and in most cases special wrenches are necessary.

Serious ignition trouble should always be turned over to an expert, although every car owner should get familiar with his ignition system by studying a wiring diagram of it.

The owner-driver can derive benefit from his effort, by using common sense in case of trouble, and by occasionally checking the motor over a misfire, a good deal of the more serious troubles will be prevented, and besides saving money it will do away with a good deal of unnecessary dependence on the garage man and mechanic.

Science of Filtering Gasoline

Government Studies Explosions from Static Charges

A STUDY of the dangers from explosions due to static electricity induced during the filtration of gasoline is being conducted by the bureau of standards of the United States department of commerce. The following comments are published in the Commerce Reports bulletin of the current week:

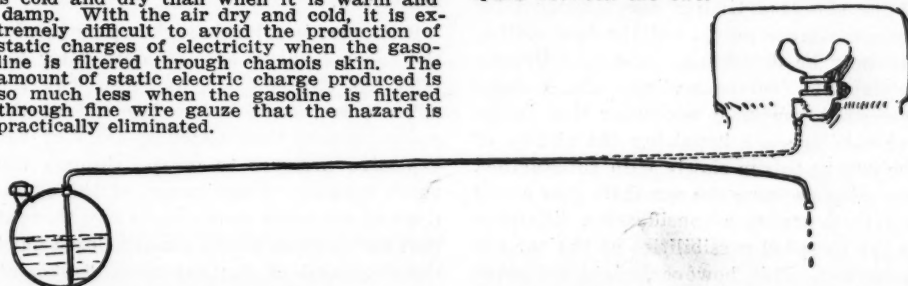
The Bureau of Standards has recently received many inquiries regarding the danger accompanying the filtering of gasoline, resulting from the production of static charges of electricity, which may produce sparks of sufficient intensity to ignite a mixture of gasoline vapor and air. The bureau is engaged in an investigation of the conditions under which such electric charges may be produced. When this work is completed the results will be published in a technologic paper.

It is found that charges of considerable magnitude may be produced when the gasoline is filtered through chamol skin, and also through other insulating filtering media. Greater charges are produced when the air is cold and dry than when it is warm and damp. With the air dry and cold, it is extremely difficult to avoid the production of static charges of electricity when the gasoline is filtered through chamol skin. The amount of static electric charge produced is so much less when the gasoline is filtered through fine wire gauze that the hazard is practically eliminated.

When insulated from the ground and the tank, the funnel receives an electric charge of one sign, while the gasoline running into the tank carries an electric charge of the opposite sign. If, then, the funnel is brought near the metal of the tank, a spark passes between the funnel and the tank, and if the mixture of gasoline vapor and air at this point is an explosive one, an explosion may result.

In addition to the electric charge produced by filtering the gasoline, charges may be produced by the friction of clothing against the cushions of automobile seats, by gloves against other materials, etc.

The danger due to the production of charges in both of these ways may be avoided by touching the funnel against the metal tank at some distance away from the opening before inserting the funnel into the tank, and then inserting it into the opening in the tank in such a way that it remains in metallic contact with the tank until the filtering is completed. The funnel should not be lifted out of contact with the tank while the filtering is in progress. These two precautions prevent the accumulation of charges of opposite sign on the funnel and the tank, respectively, and thus eliminate the possibility of the passage of an electric spark between the two.



If the gasoline does not flow out of the pipe, or comes out in a small or intermittent flow, the pipe should be disconnected from the carburetor



The Motor Car Repair Shop



Importance of Proper Valve Timing

Engine Types Differ So Much No Arbitrary Timing Formula Possible

THREE is a mistaken notion in many quarters that you can give more power to any engine by simply altering the valve timing. Many queries come in asking for the best timing for this or that engine for speed work, and they expect us to arbitrarily indicate when the inlet and exhaust valves should open and close. There is no one timing that will work best on every motor, as is evidenced by the fact that very few engines have the same timing. In nearly every case the engineer who designed the motor has had certain things in mind in the timing used, and has found for the all-around results desired with the particular motor in question that a certain relative action of the valves and pistons is best. It does not follow that this timing would also be advantageous on some other engine whose operative speeds might be different, cylinders of different size and many other factors might alter the results.

Valves Open Longer

Generally speaking, however, with the higher-speed engines that we are now using the inlet valves are left open for a greater period than they used to be where the crankshaft did not revolve so fast. It is also true that a valve setting that is of greatest advantage for high speeds is not so good when the engine is running slowly, but as it is impossible to change the timing as the speed varies, the most advantageous compromise has to be effected, and usually the designer has the thought of average running in mind when he fixes the timing. A motor car, as a rule, operates most of the time at speeds ranging from 20 to 30 miles per hour, and it is usually with this thought in mind that the timing is determined.

For speed work, therefore, the average motor might be timed a little differently if the standard timing were arranged for more moderate going, but the best setting can only be determined by trial. Usually setting the valves a little ahead helps some, but you must remember that in doing this you are impairing the ability of the engine to run slowly with satisfaction. Sometimes setting the camshaft gear ahead one tooth makes a considerable difference so far as speed possibilities of the car are concerned. This, however, might not prove out in every case and should not be taken as a positive criterion of speed change.

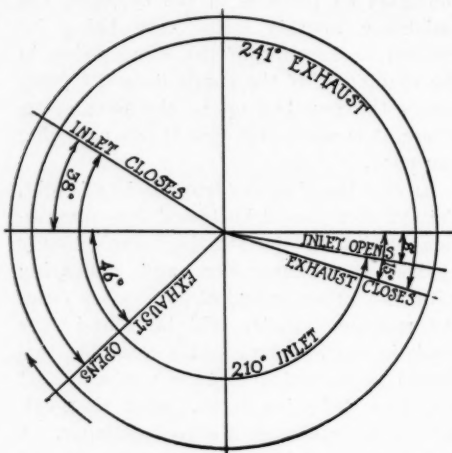


Fig. 1—Diagram indicating the timing and duration of opening of the valves on a typical four-cylinder, moderate-speed engine

One of the newer six-cylinder engines, for instance, has a timing that might not be at all satisfactory for slower-speed motors. This six runs up to much higher speeds than is usually the case, and for this reason the inlet valves are opened at top dead center and closed at 50 degrees after bottom center, while the exhausts open 50 degrees before lower center and close 10 degrees after top center. This gives quite a long duration for both valves to remain open, but the high speed makes this desirable and very advantageous. It lets the maximum amount of fuel in and serves to scavenge the burned gases in good shape.

A Case in Point

A popular four-cylinder motor, as a contrast, has its inlet valves opened at 16 degrees after top center and closed 35 degrees after bottom center, while the exhaust valves open 56 degrees before center and close 13 degrees after top center. This gives less duration to the inlet opening, but somewhat more exhaust, and there is no overlap between the closing of the exhaust valves and the opening of the intake. This engine, by the way, is a much slower-speed design than the six previously mentioned.

The point is often brought up as to why the exhaust valves are left open after the inlet has been opened, and also why the exhaust is opened before the end of the power stroke, thus allowing some of the explosive pressure to escape through the valve opening. Examination of the conditions of operation soon dispels any thought that the exhaust should remain closed until the very end of the explosion stroke, at least.

As a matter of fact, the practice is al-

Information Given As to How General Setting Is Done For Best Results

most universal of leaving the inlet valve open until the piston has not only reached the bottom of its suction stroke, but has actually started back on its compression stroke, ordinarily about $\frac{1}{2}$ inch up. At first thought it would seem that some of the gas drawn in would be forced back again into the inlet passage, but the speed of the engine must be taken into consideration. At a normal rate of running, about fifteen cycles would be completed in 1 minute with a moderate-speed engine, and at such a speed the piston has reached the lowest point of its stroke before the gas has all been able to get in, because the gas moves slower. So even when the compression stroke has begun, there is still some slight suction tending to draw more fuel in. So, to take advantage of every possibility of drawing in as complete a charge as possible, the inlet is operated for a late closing.

When Inlet Valve Closes

You can readily appreciate from this that the exact time at which the inlet valve should close depends largely upon the speed at which the engine is running at the moment, and that no one setting will work with equal advantage at all speeds. For instance, if the timing is such that the closing is late, when the engine is running very slowly, some of the gas is practically sent back into the manifold. But as the higher speed running is what we usually care most about, this low speed disadvantage is overlooked. Suppose, also, that the valve were set to operate satisfactorily at this very low speed, then when it came to running fast again the full advantage of a longer inlet would not be obtained.

In the case of the exhaust valve, it must open well before the end of the expansion stroke of the piston, and while this wastes some of the force of the explosion, this is compensated for by the quicker scavenging and the freer motion given the piston when it starts up again on the exhaust stroke. For, if the exhaust valve were not allowed to open until the end of the stroke, the piston, in starting up again would require some effort to get the gases in motion, and the upward movement would really be opposed by the same force that had an instant before driven the piston down. So the valve is opened a little ahead of time so that it

will present a free passage for the gas when the piston starts upward.

The shape of the cams also has a great bearing upon the power and operation of the motor. This also is another thing that serves to show why one timing is not always of equal advantage to two different designs of engines. Inlet and exhaust cams are very different in shape because they must operate with different objects in view. Usually the nose of the inlet cam is shorter than that of the exhaust cam, because the exhaust cam must hold the valve open for a longer time than the inlet is required to have the inlet cam open. Here again the question of compromise in design has to be considered. For the steeper an inlet cam is the more power it will bring, but at the same time it will be noisier than one which is not so steep. It takes a clever designer to get maximum power with greatest quietness.

The pointed cam is the one that gives a slow opening and slow closing with only a short period when the valve is fully open, whereas a cam which has a more nearly square face opens the valve quickly and keeps it open at its maximum for a considerable time, after which the closing is very rapid. The follower also has a great deal to do with the manner of opening and closing.

Possibly the above will give the reader some idea of the many things that enter into the operation of the valves, and will indicate how very impossible it would be for us to give a definite timing that would work with equal satisfaction on the rac-

ing car which Tom Jones is going to make out of his four-cylinder Flivver or the six-cylinder speed demon that John Smith intends constructing from his old reliable that has done many a mile at not over 30. Sometimes the timing gears can be juggled and the cams changed so that appreciable difference is obtained, but in most instances the tinkerer wishes he had let the engine alone. The car maker wishes the engine to show up to best advantage and you can rest assured that every possible timing has been tried out by the experimental department before the car was put out as a standard production.

Making a Charging Magnet

Motor Age has explained in the Readers' Clearing House on several occasions how to make an electro-magnet of sufficient size to take care of the magnetization of magneto pole pieces with a 110-volt direct current, but it might be well to go over this again, although a suitable electro-magnet equipment more satisfactorily can be secured from an electrical concern if one is going into the business of

repairing magnetos along with a general repair shop.

There are a number of sizes and shapes of electro-magnets that would do the work, but perhaps the most practical and easiest to make is one that has a diameter of about 4 inches and a height of about 7½ inches. The core should be made of a cylindrical piece of soft iron about 1 inch in diameter and you can use a disk of fibre material at either end to hold the wire on. Carefully wrap the iron core with a piece of heavy oiled paper and then shellac it. Leaving about 12 inches of length free, wind about 10 pounds of No. 22, B & S-gauge, insulated copper wire around the core carefully and evenly throughout its length. Wind the two spools in opposite directions so that a north pole of one will be opposite a south pole of the other when you assemble the two wound spools side by side on a wooden base so that they are about ½ inch apart. Connect them in series and then run the end wire from each to the current source through a switch.

The Motorists' Bookman

AN explanation of why motor car finish loses its luster, cracks, checks, peels and crazes, is given in a booklet on "The Technology of Automobile Finish," written by David S. Pratt, instructor in the school of chemistry of the University

of Pittsburgh, for A. S. Boyle Co., Cincinnati, Ohio. The author made tests of the wax preparation manufactured by that company for preserving the finish of motor cars.

The primary cause of deterioration in the finish or luster of motor car enamel, he says, is oxidation. Excerpts from the booklet follow:

"Paint is a composition of two classes of ingredients, which for the sake of simplicity may be termed moist and dry. Linseed and other oils are the moist ingredients; lead, pigments and other solids, the dry. A paint, to wear successfully, must have just the correct proportion of each.

"Oxygen, upon contact with motor car finish, draws out the moist elements from the paint. The process proceeds gradually, but surely, until eventually the 'balance' of the paint is destroyed. Its excessive proportion of dry ingredients causing it to become exceedingly hard, brittle and inelastic.

"The earliest indication of this is seen in that condition with which every motorist is familiar—loss of luster. This is due to what might be termed a superficial oxidation, a minute disintegration of the delicate surface-finish of the paint film, resulting in a deadened, tarnished appearance.

"And then, as the film grows progressively more brittle, comes the final result, quickened by super-induction. Expansion and contraction (caused by sudden and constant changes in temperature), vibration of the engine, and accidental jars and jolts are more than the brittle and inelastic paint film can resist—and it cracks, crazes, peels and checks."

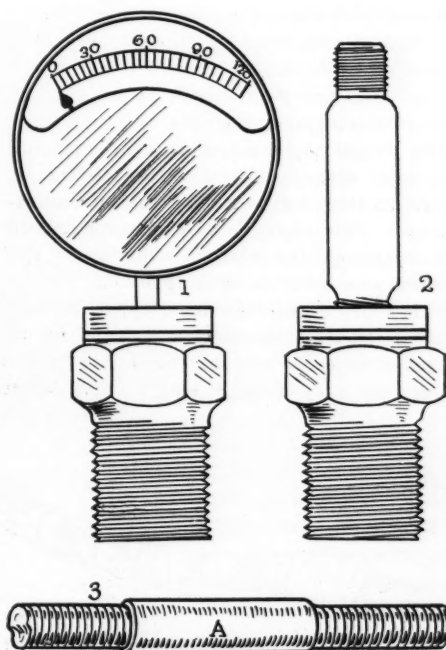
Making a Compressometer from Plug Reader Tells How He Did It

TEXAS CITY, Ill.—Editor Motor Age—Sketch 1 is a diagram of a compressometer which I made out of an old Splitdorf plug and an air gauge which I had. I first removed the mica insulation out of plug base and after tapping out the packing nut to fit threads on gauge stem, re-assembled the base, screwing the gauge in, in place of center electrode, making an accurate and cheap instrument.

No. 2 shows how to make one in case you did not have an air gauge. Saw the top end of an old tire valve off, and if you have the proper tools, thread the lower end to fit the packing nut, first threading it, and screw in, but be sure to take the valve insides out. If you do not have the proper threading tools, file or grind the lower end of stem to fit the hole in packing nut and solder it in, use with any tire gauge.

No. 3 shows how I repaired a broken speedometer shaft tubing. The part marked A is a section of tubing, cut from the frame of an old collapsible baby carriage, with the two ends of tubing slipped into it, meeting in the center, and afterwards soldered in, but I believe that it would never give any trouble if it were not soldered, as it is necessary to compress the

tubing by screwing it in, so that it makes an oil-tight repair.—Cecil C. Camp.



Compressometer from old spark plug. Also method of repairing flexible shafting

Waltham Develops New Speedometer—3 Years in Evolution

Introduces a Principle New in Speed-Measuring Devices

THE Waltham Watch Co., which 5 years ago entered the motor car field, and has since been marketing a complete line of Waltham clocks for motor cars and trucks, has developed a new principle-speedometer, of which it is about to start making deliveries. The company has taken up the development of this speedometer in the same systematic manner it did its clocks and already has organized a large department in its factory, the largest watch factory in the world, where it assembles all parts of the speedometer.

These parts are being manufactured in the different departments of the watch factory, and watch standards of accuracy are applied to all of them. The development of this speedometer was started in the experimental department of the Waltham company, 3 years ago and the instrument has been going through the evolutionary stages since that time. The instrument is today not an untried experiment but a known quantity and several manufacturers have been using it on test cars for many months.

Production already has begun, the first lot of 25,000 is going through the factory. The instrument will be known as the Waltham and has been developed and is being manufactured to meet the demands of quality car builders. The instrument lends itself to application on cars of all prices. That the Waltham company has entered the speedometer field in earnest is attested by the fact that negotiations are already well advanced for a countrywide selling and service system. The instrument is being sold and guaranteed by the Waltham Watch Co.

The Waltham Speedometer is an air-friction type and introduces a principle



Fig. 1—The quick reset device for the trip odometer. This is a feature and consists of a push button adjacent to the reset crown

new in speed measuring and one which has not been previously used in any form of instrument. This part of the speedometer consists of two essentials, a driving cup and telescoping with it a driven cup. The driving cup is driven by a flexible shaft from the road wheel or transmission system. The driven cup, also known as the indicating one, is inverted within the driving cup and separated from it by a slight air space. It is the friction generated in this annular air space between the cups which is the speed measuring medium.

The relationship of these two cups is best shown in the lower right Fig. 3. Each cup is in reality a double cup. Thus the revolving cup, K, consists of two concentric brass cups, K1 and K2, having an annular space, 108 centimeter between the two vertical walls called ribs for convenience. The cups K and K1 are rigidly mounted on the vertical shaft S so that when one revolves both revolve.

The driven or indicating cup C is made up of two aluminum cups C1 and C2 attached together so that to all intents and purposes they form a single cup. These

Air - Friction Type Not Previously Found in Any Instrument

cups are extremely light, being made of aluminum 8/1000 of a centimeter thick. This means that 313 of these cup thicknesses would be required to make 1 inch.

The aluminum cup C when in position in the instruments has the inner rib C2 floating in the annular space between the ribs K1 and K2 of the brass cup. The outer rib C1 of the aluminum cup floats outside of the brass rib K1. There is an air space at all times of .5 millimeter between the ribs of the brass and aluminum cups. On the outer face of the aluminum cup are the calibration figures to indicate the speed in miles per hour.

Fig. 2 is a photographic reproduction of the interior of the speedometer with the dial removed and shows how the aluminum cup telescopes the brass cup. The revolving of the brass cup generates the air friction which would revolve the aluminum cup also, were it not for a regulating hair spring shown in the upper left Fig. 3. This hair spring is so adjusted as to permit the correct oscillation of the indicating cup according to the speed. This regulation between the hair spring and the tendency to rotate is so accurate that the instrument indicates immediately all speed changes, and indicates as low as 1/2 miles per hour.

The principle of air friction between re-

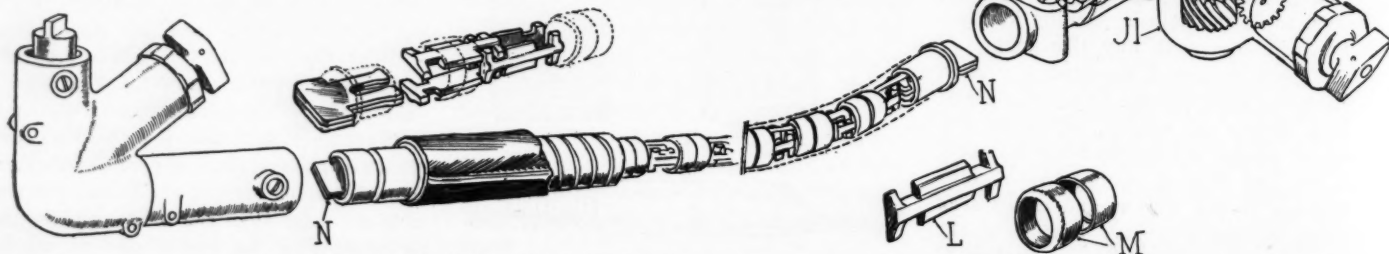


Fig. 4—Showing the flexible shaft together with other fittings, including swivel and angle joints

volving concentric cups has been proven to be directly in proportion to the speed of the revolving cup, in this case the driven brass cup. It is this fact that makes a uniform calibration possible without adding compensating devices to gain this end. The principle of indicating speed through air friction is covered by patents controlled by the Waltham company. Comprehensive laboratory tests have proven that air friction is not influenced by heat, cold, or altitude up to 10,000 feet. The revolving cups have not to be carried in an air-tight compartment, and no sealing is necessary.

Season and Trip Odometers

Incorporated in the instrument as shown in Fig. 2 are season and trip odometers, both characterized by having particularly large figures spaced closely together. The odometer figures are black excepting those indicating tenths, which are red on both the trip and season. The trip odometer registers up to 999.9 miles and the season odometer to 99,999.9 miles and repeats. A quick reset device for the trip odometer is featured and appears in Fig. 1. Close to the dial is a press button and adjacent to it a reset crown. By turning the crown, or ball, and without pressing the button you can reset the tenths and total trip; but by pressing the button you can reset the entire trip mileage ten times as fast.

The separate indicating wheels in the trip and season odometer are placed close together which makes it possible to use large figures. This placing of these wheels so is made possible by the use of an internal sun and planet gear drive between the adjacent wheels. In every speedometer what is known as the head incorporating the odometer and speed measuring device,

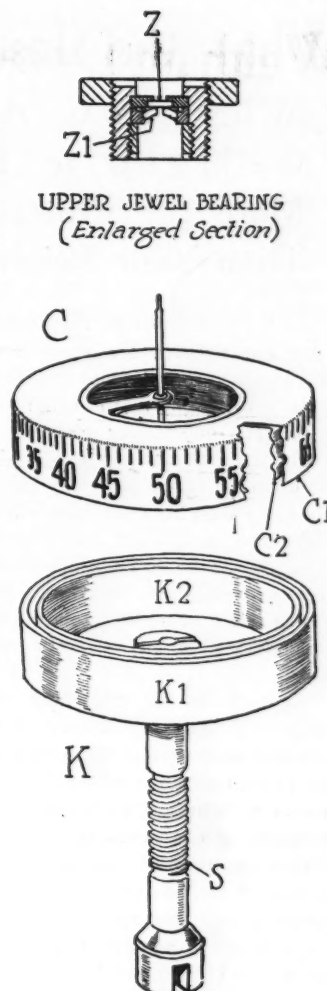
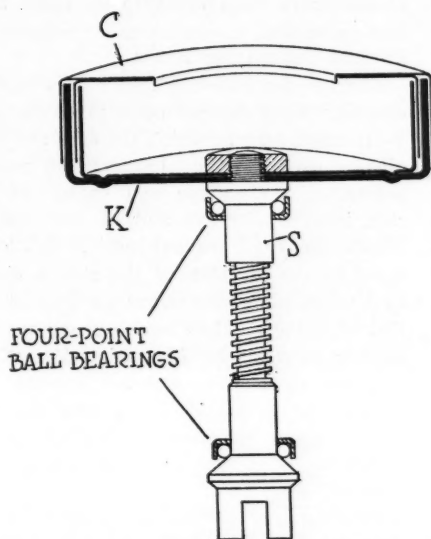
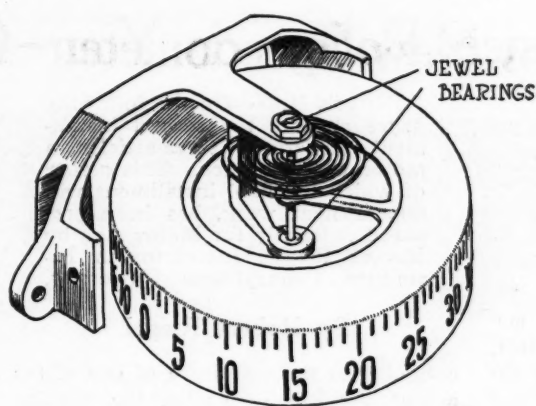


Fig. 3—Diagram showing relationship of the various parts

constitutes one part of the instrument and the second and equally important part is made up of the flexible shaft together with the fittings including swivel joint, angle joint, etc., as shown in Fig. 4. The Waltham company has given as much attention to this second part of the instrument.

The flexible shaft is a patented design of the company, and is made up of a series of interlocking links L, which are held in position by a series of steel collars M so that it is impossible for the links to come apart. The chain is assembled from one end to the other and it is impossible to take it apart in the middle or at any other point except from either end. No rivets are employed in it, and it is such that it can be assembled or taken apart by an experienced workman without the aid of any tools and in a very

short time. The only tool necessary in dismantling the chain is a pair of pliers to remove the locking male member N in the driving connection at either end. This done, the entire linkage can be taken apart. All of the links, L, are heat treated nickel steel stampings. The collars M are of the same material. Surrounding the chain thus formed is the usual flexible casing with a leather cover as optional.

The swivel joint at the driving end of the flexible shaft is a Waltham design. The swivel joint consists of two, a pair of spiral bevels, SB, and a pair of bevel gears, B. A feature of this swivel joint is the quick means of dismantling in that the housing cap H is snapped in position and when removed permits of removing the pin P from the retaining collar on the top of the shaft. This done, the entire housing, J, is removed, leaving the vertical shaft carried on the lower part of the housing, JI. A large grease cup is an integral portion of the swivel joint.

In designing the driving mechanism, the Waltham company has endeavored to have the swivel joint, shaft, and shaft casing, interchangeable with other standard instruments. The revolving brass cups, K, Fig. 3, must revolve 1,008 times to the mile. With the aid of gear ratios in the angle joint or swivel joint, Fig. 4, the flexible shaft may revolve at 680 or 1,008.



Fig. 2—This illustrates the interior of the instrument with the dial removed and shows how the aluminum cup telescopes the brass cup

What the Insurance Policy on Your Car Means to You

Why You Are Obligated to Pay More for Protection Than Your Neighbor

INSURANCE rates as they apply to motor car policies are many and varied. One locality may enjoy a rate that appears very high, while others have low rates. The boundaries of these zones are clearly defined and the car owner on one side of a zone boundary may pay considerably more than his next door neighbor, providing the imaginary line separating the zones, or districts, falls between the two places of residence. Just why this should be so is not thoroughly understood by anyone, unless it is the body that makes the rates.

"In insurance all roads leads to the rate question." This statement of an insurance official is justified by the numerous factors in insurance which are connected, directly or remotely, with the premium and its computation. Certain it is that the primary interest of the car owner is in the cost of the protection which motor car insurance provides against loss. In spite of this fact the manner of arriving at the rate which he is quoted is usually a mystery to the policy-holder.

Why is he charged more on his Cadillac than is Smith on his Simplex? When he has collision clauses indorsed on his policies why must he pay more on his Packard limousine than on a Packard coupe? Only numerous questions will extract the information from the agent, who expects to spend his time in writing insurance rather than in pedagogy, and books on the subject are unavailable. A concise explanation in simple terms will answer many of his questions and doubts.

Three Kinds of Protection

Casualty companies furnish three kinds of protection against loss: liability insurance, which protects against legal liability for personal injuries to others; property damage insurance, which protects against legal liability for damage to others' property; and collision insurance, which indemnifies the owner for damage to his own car. The premiums for property damage insurance, statistics of which are available, show an immense growth in the last few years, having increased from \$233,369 in 1908 to \$4,374,933 in 1913 or 1,700 per cent. In addition millions of dollars are collected on liability policies. The reason for the increasing popularity of motor car insurance is the fuller realization by owners of the perils which this form of protection removes. The proportion of all accidents caused by motor cars has steadily risen during the last 7 years until,

Editor's Note—On the following pages appears the second installment of a series of three articles on motor car insurance. This series, of which the final installment will appear next week, has been prepared especially for Motor Age by Robert Riegel, Instructor in Insurance, Pennsylvania University.

By Robert Riegel

according to the experience of one of the largest accident companies, the Fidelity and Casualty Co., motor car accidents occasion more than one-fifth of their total loss payments.

Factors Influencing Rates

Charges for insuring motor cars against casualty risks depend upon three factors: 1—the territory in which the cars are principally used, 2—the character of motive power, 3—the nature and extent of the risk insured against and, 4—the use to which the cars are subjected. With respect to the location of the risk a classification is made of various sections of the United States. Thus in one group we find certain counties of Massachusetts, where the rate on a 49 horsepower private passenger car is \$57.50 for public liability protection, as compared with \$55.50 in another group including certain sections of Pennsylvania.

The liability of the company is determined by law. Since the liability laws of the various states differ it is obvious that the insurance company may be called upon to pay more in one state than in another for the same accident, and that the rate in the one should be higher than in the other. Again the traffic conditions are an

How the Different Clauses or Indorsements Take Responsibility of Insured

power in proportion to their power of propulsion. They are, on the whole, a distinctly better risk than a gasoline car, since accidents caused by them are neither so frequent nor so severe. All these factors contribute to the lower rates. The rates on gasoline cars are based on their capacity for injury as measured by horsepower. Thus the rate on a 46-horsepower car for public liability insurance is about \$52.50 while on a 50-horsepower machine it is \$56.50. This method of rating, while as good as any yet devised, cannot be called scientific, as will be shown later.

As regards the nature and extent of the risk, any system must provide a method for computing a premium for liability insurance, insurance against property damage, and collision insurance, as well as any other risks, not falling in these three classes, assumed by indorsed clauses. Some provision must be made by the rating system in each of these divisions of risk for the various classes of car usage. Thus, under liability risks we have private passenger cars, public motor cars, commercial vehicles and manufacturers' and dealers' cars. The same is true of property damage, collision and other hazards. The general bases of rate-making, for each of the classes, may be indicated by the following diagram:

Risk insured against	Pleasure	Public	Commercial	Manufacturers' and dealers'
Liability	Horsepower (except electrics)	Horsepower	Business in which used	Total payroll or number of chauffeurs
Property damage	Horsepower	Horsepower	Business in which used	Number of cars operated
Collision	List price	List price	List price	List price

influence in determining the cost of protection, and while a separate rate for every city is an impossibility, urban and rural districts may to some extent be distinguished between. Thus in 1914 the rate for public liability insurance on a 49-horsepower car in Greater New York was \$92.50 as compared with \$69.50 for the balance of New York State and northern New Jersey.

With regard to the nature of the means of propulsion, the rates for electric vehicles are upon a per car basis, while the gasoline car rates depend upon horsepower. The electric rates are lower than those of any gasoline car. Cars driven by electricity are capable only of a very ordinary rate of speed, are often driven for social purposes and have a high braking

Passenger Cars—The rates for liability risks on this class of machines are based upon the horsepower of the car and the amount of insurance desired. The horsepower is calculated by the N. A. C. C. formula. As an illustration of the method of arriving at premiums let us assume that the car to be rated is a Packard, 1914 Model, No. 48, touring car. The first step is to ascertain, from a list of all makes and models printed by the insurance company, the horsepower of this machine. The table, Form A, on the opposite page, is an illustration of portions of such a list, on which rates are based.

In this list one sees in the seventh column headed "Ins. H. P." that the horsepower of the assumed car is 49. Use must now be made of the company's rate-book

FORM A									
Name and Mfr.	Year	Model	Adv. H.P.	Type of Body	List Price	Ins. H.P.	Col. Cls.		
Ford Motor Co., Detroit, Mich.	1912	T	20	Road.	\$ 590	22	A		
				Tour.	690	22	A		
				Tour. Car.	900	22	A		
				Run.	525	22	A		
				Tour.	600	22	A		
Packard Motor Car Co., Detroit, Mich.	1913	T	20	Tour. Car.	800	22	A		
				Tour. Car and Coupe.	750	22	A		
				Run.	4,650	49	O		
				Phae. Run.	4,700	49	O		
				Phae.	4,750	49	O		
				Tour.	4,850	49	P		
				Vict. Phae.	4,930	49	P		
				Vict. Tour.	5,065	49	P		
				Coupe	5,400	49	Q		
				Imp. Coupe.	5,600	49	R		
				Cabette	5,800	49	R		
				Salon Brough.	5,850	49	R		
				Brough.	5,900	49	R		
				Lim.	5,900	49	R		
				Lau.	5,900	49	R		
				Salon Lim.	6,050	49	R		
				Imp. Lim.	6,100	49	S		

for the particular territory in which the risk is located. Thus, assuming the place to be in Pennsylvania we use the Pennsylvania rate-book, turning to the section on private passenger cars. The page necessary will be somewhat similar to the following:

FORM B				
PREMIUMS—LIAB. AND PROP. DAMAGE				
H.P.	Pub. Liab. only	Pub. Liab. and Emp.	Pub. Liab., Emp. Liab. & Comp.	Prop. Dam. Prem.
46	\$52.50	\$55.00	\$62.50	\$17.25
47	53.50	56.00	63.50	17.50
48	54.50	57.00	64.50	17.75
49	55.50	58.00	65.50	18.00
50	56.50	59.00	66.50	18.25
Electrics	15.00			
Motor C.	17.50	20.00	27.50	7.50

For the particular car mentioned, therefore, it can be seen that it will cost \$55.50 to insure against liability for injuring the public; \$58 to insure against liability for injuries to the public or the chauffeur, and \$65 against public and employers' liability and compensation for one chauffeur under the law of any state. It is readily apparent from this table that these rates are based solely on horsepower.

Basis Rates

For the sums just mentioned—known as basis rates—the companies agree to be responsible for any loss resulting from the specified hazards up to the sum of \$5,000 for one person and \$10,000 for any one accident. If it is desired to insure the selected car to greater limits reference must be had to the company's table showing the rates for various limits, which has the following appearance:

FORM C		Per Cent of Basis Rate
Limits		
\$ 5,000—\$ 10,000		100
7,500—10,000		112
7,500—50,000		172
10,000—10,000		115
10,000—50,000		175
15,000—15,000		132
15,000—50,000		180
20,000—20,000		155
20,000—50,000		190
50,000—100,000		200
100,000—200,000		210
100,000—250,000		215

If the owner of the car assumed desires to be protected to the extent of \$7,500 for

one person's injuries and \$10,000 for injuries sustained by more than one person in one accident, he will have to pay 142 per cent of the basis rate—\$55.50, for instance—or \$62.16. No reduction from the basis rate will be made, however, for limits of less than \$5,000 to \$10,000 in any case.

FORM D			
Premiums—Public Motor Cars Other Than Livery Vehicles			
	Pub. Liab. Only	Prop. Dam. Prem.	
Hotel omnibuses	\$200	\$60	
Taxicabs	200	60	
Vehicles designed to carry 2 but not more than 12 passengers	200	60	
Vehicles designed to carry more than 12 but not more than 20 passengers	300	90	

Public Vehicles—This class is sub-divided into livery vehicles, comprising cars of the private pleasure type used as public conveyances, and "others," the latter designation including hotel omnibuses, sight seeing motor cars and taxicabs. Rates for the liability risk on livery vehicles are found by the same process as used for finding liability rates on private cars except that the appropriate table is employed. The rate is determined by the horsepower of the car. At 49 horsepower livery vehicle rate compares with the rate

on a private machine, according to one company's rate book, as follows:

PUBLIC LIABILITY ONLY	
Livery vehicle	\$145.00
Private vehicle	55.50

This is an excellent illustration of the influence of usage upon the rate. If the car is insured as a private pleasure vehicle the policy prohibits the carrying of passengers for hire. On public vehicles other than livery, however, the horsepower basis is not employed. These rates are specific, depending upon the capacity of the car. The table below, Form D, will serve as an illustration.

It is evidently considered that the greatest source of accidents, as regards this class of usage, will be the passengers carried, and the rate basis is accordingly carrying capacity, not speed.

Commercial Vehicles—For the purpose of rating these machines are divided into five classes according to the business in which used, each of which groups is subdivided into two sections designated by the letters "A" and "B." Thus in Class A, that of greatest hazard, we find baggage

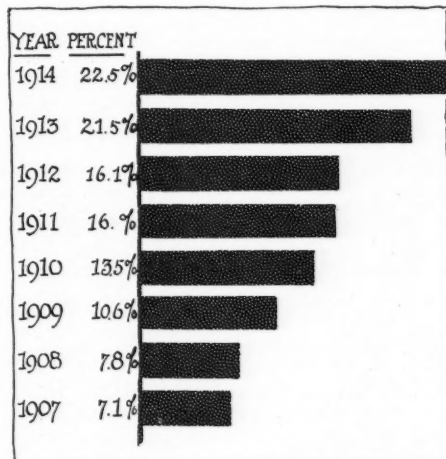
transfer motor cars, and in class 4A, of small hazard, butter and egg merchants' vehicles.

Chief among the factors determining the class of a vehicle are the character of the business it serves and the territory in which it is consequently compelled to operate.

FORM E			
Premiums—Commercial Cars			
Class	Pub. Liab. Only	Prop. Dam. Prem.	
1 (a)	\$125.00	\$50.00	
(b)	125.00	50.00	
2 (a)	100.00	40.00	
(b)	100.00	40.00	
etc.	down to \$50.00	down to \$14.00	
The usual rule regarding liability limits applies. See Form C.			

D. Manufacturers' and Dealers' cars—Rates on this class may be computed on either of two bases, namely, 1—per named chauffeur or specified car, or, 2—per \$100 of the total payroll. Thus let us suppose that a dealer desires protection against liability to the public and that he is to be rated on the basis of the cars covered, 150 in number. The rate sheet shows the following:

FORM F			
Manufacturers' and Dealers' Cars Named Chauffeur or Specified Car Basis			
	Pub. Liab. Only	Prop. Dam. Prem.	Per named chauffeur or per specified car
Gasoline or steam	\$70.00	\$23.00	
Electrics and motor-cycles	50.00	20.00	
His rate for gasoline or steam vehicles therefore would be 150 times \$70 or \$10,500.			



The proportion of all accidents caused by motor cars has steadily risen during the last 7 years until it is said these accidents occasion more than 20 per cent of a big company's total loss payment

The Readers' Clearing House

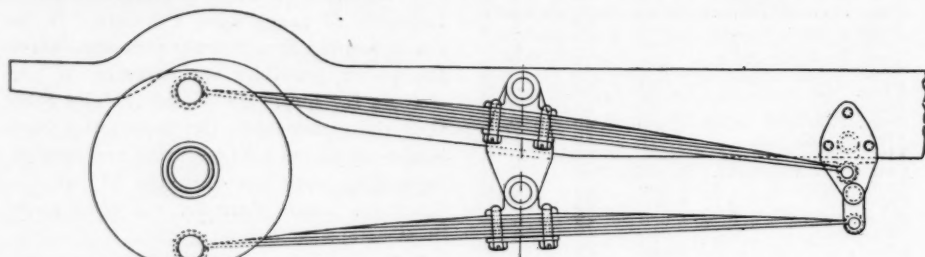


Fig. 1—Illustrating the mounting of the Austin double cantilever spring

CURIOSITY CONSIDERABLY AROUSED

Must Not Jump at Conclusions Before Giving a Fair Trial in All Cases

TAFT, Cal.—Editor Motor Age—Why is it that a four-cylinder motor of given bore and stroke will not develop four times the power of a single-cylinder motor of same dimensions?

2—Why will a four-cylinder motor turn over faster than a six? I have heard it said that a four will do so because the friction surface is less. It seems to me there must be another reason, for, when there are added cylinders and friction surfaces, there is added horsepower in proportion.

3—Why is it that a six-cylinder motor has more carburetor trouble than the four? And why does the carburetor load up so quickly while standing or running idle? All that have come under my observation seem to be alike, and for this reason I cannot make myself believe it is due to carburetor adjustment.

4—Is it not a fact that there is some positive reason for sixes being more or less of a failure? It cannot be the length of the motor and the distance of gas travel, for a twelve-cylinder seems to work better, although the lengths and travel of gas are the same.

5—Why is it that carbon deposits are not alike in cylinders, where the compression and lubrication are alike? I have a four-cylinder motor in mind, which was used in a certain car during 1915. The third cylinder in all of these motors have spark plug trouble. Upon careful examination the compression was alike within 2 pounds. The lubrication was exact in all cylinders.

6—Why is it that multiple cylinder motors are so hard to adjust in a high altitude, and the adjustment of a single is just as easy?

7—Has high altitude any effect upon ignition?

8—Why is it there seems to a weak cylinder on all multiple cylinder motors while running idle? For a time I thought it was due to the design of manifold, but after seeing it tried out with the manifold taken off the defect seemed to be the same.—W. Arthur Norris.

1—It should theoretically, of course, but mechanical considerations enter, bearing surfaces increase and other factors enter to cut down the total. There are some engines that come pretty close to this idea of multiplying by the number of cylinders.

2—There are as many, if not more, high speed sixes today than there are fours, and you evidently have a wrong conception. Examine the specifications of some of the latest cars and you will see that sixes are just as fast if not more so.

3—Naturally, the carburetion of a six is more difficult than a four, but you are not correct in assuming that every six has more trouble than every four. Possibly the engines that have come under your observation have not been of the best, or the carburetors might have been out of adjustment.

4—Sixes are not a failure. Many of the leading makers of cars have six-cylinder models, and new ones of great merit re-

cently have come out. You cannot be following present day design very closely if you have this impression.

5—Possibly there was leakage past the rings. The ring joints might have all been in one line in the particular cylinder, causing oil to get up into the cylinders. There is bound to be some variation in any mechanical apparatus.

6—High altitude will affect the power of any motor, because the atmospheric pressure is lower. There should be no more trouble in one engine than another.

7—No, not to our knowledge.

8—There is no reason why there should be a weak cylinder, and because one engine might have shown up that way, you should not jump at conclusions and assume that such a thing is a common trouble. You might ask why there was a weak cylinder in all four because you happened to investigate one that happened to have a weak member. Conclusions of this kind cannot be reached without investigation of all representative engines of a type. There is something the matter with any engine that has a weak cylinder, either due to ignition or carburetion adjustment or to some other cause that is traceable.

Austin Double-Cantilever Spring

St. Louis, Mo.—Editor Motor Age—I am interested in the double cantilever spring and would appreciate it if you can show in the Readers' Clearing House department of Motor Age a diagram of the double cantilever spring such as is used on the Austin car.—G. K. W.

Communications Received and Inquiries Answered

W. A. Norris.....Taft, Cal.
C. W. K.....St. Louis, Mo.
Heri Hart.....Carmichaels, Pa.
E. C. Aspegren.....Courtland, Kan.
Paul Love.....Garrettsville, O.
McDonald Stephens.....Toledo, Ill.
C. R. Lundell.....Kiron, Ia.
W. C. M.....Alliance, Neb.
A Subscriber.....Kentland, Ind.
A Reader.....Stromsburg, Neb.
B. S. Foreman.....Tacoma, Wash.
G. M. McLeod.....Crary, N. D.
A Reader.....Grand Rapids, Mich.
Arlo Kunkel.....Carthage, Ill.
Arthur Schiele.....Durant, Ia.
Reader.....Fort Scott, Kan.
O. E. Carroll.....Detroit, Mich.
Theo. Schneider.....Louisville, Ky.
C. B. Spore.....Union City, Mich.
H. G. Mason.....Waterloo, Ia.

No communications not signed with the inquirer's full name and address will be answered in this department.

1—Fig. 1 shows the Austin double cantilever spring and the way it is mounted on the frame of the car.

EVERY ENGINE NOT FOR SPEED

The Idea Is too Prevalent That Any Motor Can Be Tuned for Racing

Carmichaels, Pa.—Editor Motor Age—I am having some trouble with my Chalmers 36, the enamel is coming off of sight-feed. Can this do any harm to bearing by the oil going direct from sight-feed to timing gears?

2—Is this machine capable of doing speed work if tuned up with this type of motor? What changes would be necessary? I have driven this car, which is a touring and standard equipped with 37 by 4½ tires, around 55 m. p. h., but while traveling at this speed the motor seems to have more speed but runs away from speed of car.

3—Can I secure any better racing body for a Ford than the type built by the Champion Racer Co.? How about the weight—is it too heavy or not? Is the narrow radiator any advantage over the V type? Would it give the motor sufficient air around it to keep it cool?

4—I saw a peculiar looking racer at the Uniontown hill climb which they say was the Beaver Bullet built in Beaver Co. for the Indianapolis track. Can Motor Age supply me with an illustration of this machine and some of its mechanical parts?—Heri Hart.

1—It certainly will not do the bearings any good to allow this foreign matter to be brought to them, if that is what you mean is happening. Better clean out the sight feed and prevent its circulating through the system, as it might also clog the oil piping. It will not do the sight feed any harm to lose its enamel, but it harms the lubricant.

2—It might be made to attain fairly good speed, but you must remember that a touring car motor is not designed for the continuous high speed strain to which a racing engine is subjected. You might tune it up by altering the valve timing, adjusting the carburetor for speed work, etc., but Motor Age is not any too favorable toward such alterations.

3—We are not familiar with the body built by this concern, but evidently they know what they are doing or they would not put them out. We can see no special advantage to the narrow radiator except appearance, unless it gives a larger cooling area than the regular shape. It is not so much the aim to keep the motor cool by circulating air around it, as it is to afford cooling area for the water that is circulating through the radiator and through the engine.

4—This will be shown next week.

About the Dodge Motor

Courtland, Kan.—Editor Motor Age—What is the most efficient speed in revolutions per minute of the Dodge Bros. motor?

2—At what speed is the maximum horsepower secured?

3—What is the speed of the Dodge motor?

4—What horsepower has it running 10 miles an hour?

5—What horsepower has it running 25 miles an hour?

6—How many Dodge cars in Kansas, first twelve months output?—E. C. Aspegren.

1—This would be almost impossible to

state, as it runs equally well up to its maximum speed. Probably, however, it might show a little better at a car speed of 25 to 30 miles an hour than at any other speed. This is a little under 1,000 revolutions per minute of the engine.

2 and 3—The maximum speed is 2,000 revolutions per minute.

4—About 5 horsepower.

5—About 16½ horsepower.

6—Motor Age is not in possession of these figures.

DELVING INTO DESIGN OF TRUCKS

Reader Going Far Below the Surface on Truck Efficiency

Garrettsville, O.—Editor Motor Age—In a 3-ton truck how many hours service is expected of the drive chains before they or their sprockets need replacing?

2—How many hours' service is expected of the worm drive under similar conditions?

3—In a new truck what per cent of the engine power is delivered to the rear wheels when driving through a jackshaft and side chains?

4—What per cent will the worm driver deliver?

5—What per cent of the engine power is delivered through the transmission when running on one of the indirect drives?—Paul Love.

1—Conditions of service vary so greatly that it would be next to impossible to state. Some trucks will travel many more miles than others without replacements, due to carefulness in driving, road conditions and other determining factors.

2—The same applies to the worm drive, although the generally greater adoption of the worm drive in preference to the chain leads to the belief that the worm drive, if efficiently designed and mounted, will give longer service than the jackshaft and chain type of drive.

3 and 4—This has been variously stated, and here again the design has a great deal to do with it. Some drivers are more efficient than others. In either case the efficiency is well over 90 percent.

5—We have no good data on this. By that we mean that while we have figures from various sources, they vary so much that we are unable to form any conclusions that would answer your question with satisfaction.

ADJUSTING STROMBERG MODEL HA

Reader Asks for Instructions Covering the Setting of Carburetor

Kentland, Ind.—Editor Motor Age—I have been having some trouble in getting the Stromberg carburetor, model HA, No. 2, on my car, to give the proper mixture. Will you please give a diagram and instructions for the adjustment of this carburetor?—A Subscriber.

1—A cross section is shown in Fig. 2. There are only two adjustments on the type HA carburetor, the low speed, which is a needle valve seating in the primary or low speed nozzle, the opening of which is two sizes larger than is ordinarily necessary. This permits a limited increase in the gasoline flow which can be shut off as desired. The other is the high speed adjustment which controls the flow of gasoline on high speed by regulating the time when the secondary needle valve begins to open. The action of this needle is automatic for as the air valve opens and allows an increased amount of air to enter the

carburetor, the needle is unseated and an increasing supply of gasoline is delivered.

The float level and the air valve spring adjustments are set and locked at the factory and need no attention. For a trial adjustment before starting turn low speed needle three full turns off its seat, and see that there is approximately $\frac{1}{2}$ of an inch clearance between the top of the high speed adjustment and the auxiliary needle at B. Also be sure the rocker arm of the dash adjustment on the carburetor is not in contact with the collar above it when steering post control is clear down.

The motor now is ready to start. First see that all the air entrances through the carburetor are closed. This is done by pulling up the dash or steering post controls, which govern the auxiliary needle.

Immediately after the motor is started, open the valve in the air horn by pushing down the control. After the motor has warmed up return the auxiliary needle to its seat. For low speed adjustment slowly close the low speed needle until the motor runs smoothly at low speed.

For high speed adjustment advance the spark, open the throttle. If the mixture is too lean on high speed turn B to the left or up until the desired results are obtained. If mixture is too rich turn B down or to the right.

LAPPING IN OF RINGS AND PISTONS

Use Plenty of Oil and Drive Engine by Belt or Other Means

Toledo, Ill.—Editor Motor Age—Is it not possible to get a perfectly round bearing when the lower half of the bearing has to be filed off, especially in case of a badly worn bearing? Should a reamer be used to get a perfect bearing or can same be secured by means of a scraper?

2—In lapping in bearings and rings on a Ford motor, is it best to assemble motor and use a rear wheel as a pulley to drive motor? If motor is lapped in out of crankcase, how is lubrication taken care of? At what speed should a motor be lapped in at?

3—In lapping in new rings and pistons, oversized or regular, should each be lapped in separately; that is, the rings or an old piston and new pistons without any rings on?—McDonald Stephens.

1—It is entirely possible to get a round bearing if you scrape it in and fit it properly.

2—You could do as you suggest and drive the engine through a rear wheel, or you could lap in the pistons and rings by driving the engine by a belt direct. Put the crankcase on so that the engine will splash its own oil into the cylinders, and use the oil copiously during the process. Put the engine at about 500 or 600 revolutions a minute, or even slower.

3—The simplest way is to assemble the new rings to the new pistons and then lap them in together in one operation.

GEARS ARE NOISY WHEN IN SECOND May Be Due to Worn Bearings of Layshaft or Mainshaft if Worn

Kiron, Ia.—Editor Motor Age—What causes the gears in the transmission of my 1910 Pratt Elkhart to be unusually noisy when driving with the intermediate speed? This car is equipped with the Cotta transmission. I have examined the transmission and find the gears all in good shape with no unusual play in any of the bearings. I have been using a medium grade of grease in the gearbox. Would it be better to use a heavy grade of castor oil?—C. R. Lundell.

1—It is natural for you to have some noise on intermediate, but the only cause to which we can point without further information is wear in the gears. Possibly the shafting itself is worn or the shaft bearings need adjustment or replacement. Castor oil would not help any. Try some heavy transmission oil—any of the well-known brands on the market. The trouble with grease is that it gets thrown off the gears easily.

Putting Ammeter on Regal

Alliance, Neb.—Editor Motor Age—Kindly explain the method of attaching an ammeter on a model D 1915 Regal.—W. C. M.

Connect it into the main circuit to the battery so that the current passes through it. You could run one of the leads that now connects to the battery to one side of the ammeter instead, and then another wire from the other terminal of the ammeter to the battery terminal to which the first-mentioned wire previously was attached. You can determine the positive and negative terminals of the ammeter by trial. That is, if when connected the ammeter does not read the right way, the terminal connections should be reversed.

Attaching Ring Gear

Stromsburg, Neb.—Editor Motor Age—How can I fasten the gear ring to the differential of a Maxwell mascot 1912 car? It has been riveted both hot and cold, but has come loose three times. The holes cannot be reamed larger or more of them made for a larger number of rivets, because the gear ring is too

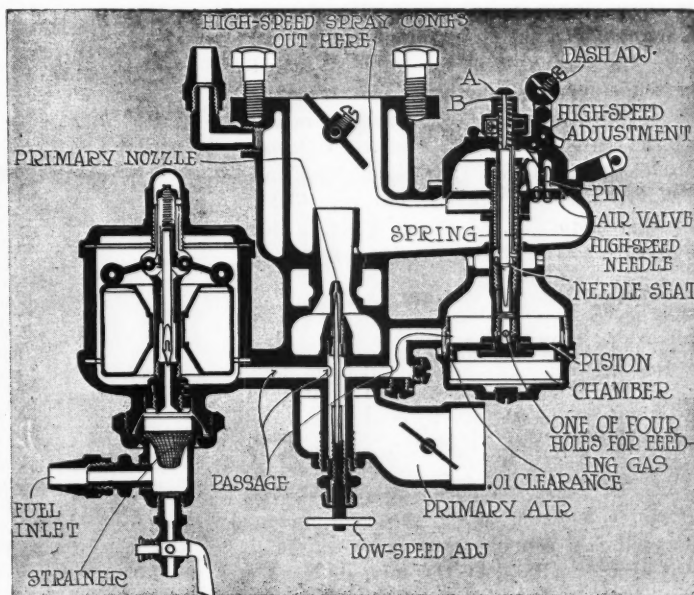


Fig. 2—Cross-section of Stromberg carburetor

hard. This gear shows but little wear and I do not wish to discard it. Would rusting or otherwise roughening the surfaces before riveting together help to prevent their slipping and starting to wear the rivets? This seems to be where the trouble usually starts. Would you heat the rivets or not?—A Reader.

Try using bolts with castellated nuts locked with cotters. Or, the holes in the differential might be threaded to take studs, but the former suggestion is easier provided there is clearance for the bolt heads and nuts.

QUERIES CONCERNING THE HUDSON

Ratios Used in Sheephead Bay Tests—Six a Balanced Engine

Tacoma, Wash.—Editor Motor Age—What advantage did the Hudson super-six exercise in its recent speed trials in using 34 by 4 tires instead of 35 by 4½, this model's regular size?

2—Were the records established by this car with a 3½ to 1 gear ratio or 4 5-11 to 1?

3—What is the gear ratio and speed of the 1914 Hudson 6-40 model?

4—What is the per cent of power lost, if any, on a six-cylinder motor on account of not being a balanced engine?—Byron S. Foreman.

1—None except that the tires used were found to stand up better than others.

2—Both. The speed records were made with a 3½ to 1 ratio, and the acceleration tests with the 4 5-11 to 1 ratio.

3—The gear ratio fitted to most of these was 3.75 to 1, although a small number have a 4½ to 1 ratio. The speed depends largely on the condition of the car, and it of course varies. The average, however, would be anywhere from 55 to 60 miles an hour.

4—The six is a balanced engine.

FEW STARTERS ON FOREIGN CARS Electric Starting and Lighting Are Added Equipment on Many of Them

Crary, N. D.—Editor Motor Age—Do Italian cars use electric self-starting and lighting systems?

2—Is the Franklin the only air-cooled car made?

3—What is the N. A. C. C. horsepower of the following cars: Studebaker, series 17C, National Highway Twelve, Packard Twelve, Cadillac eight, Mitchell six, Dodge and Willys-Knight?—G. M. McLeod.

1—Electric starters as stock equipment are not common on foreign cars. Many of them, however, are fitted with electric starting and lighting as added equipment.

2—The Franklin is the only air-cooled passenger car in America.

3—The N. A. C. C. horsepower rating of the cars mentioned are as follows: Studebaker, 6-50, 36.04; National Highway Twelve, 36.40; Packard Twelve, 43.20; Cadillac eight, 31.25; Mitchell six, 29.40; Dodge, 24.03, and Willys-Knight, 27.23.

Testing Storage Battery Condition

Grand Rapids, Mich.—Editor Motor Age—I am having some trouble with my storage battery and would like to know how to make hydrometer readings and just what to look for when readings are taken and what they mean.

1—Will you please show by diagram the condition of a battery as shown by the hydrometer when the battery is fully charged, one-half charged and fully discharged?—A Reader.

1—Fig. 3 gives a good idea of the hydrometer showing when the solution in the cells of your battery is in different states of density. At the left, in the illustration, is shown how the specific gravity of the fully-charged cell registers on

the hydrometer. In the middle is the condition of the cell when only one-half charged and at the right is shown the hydrometer reading of a fully discharged cell.

SOME DATA ON THE HUDSON SIX-54 Carburetor Evidently Out of Adjustment— Hydrometer Indicates Gravity

Carthage, Ill.—Editor Motor Age—Kindly answer the following question regarding the 1913 Hudson 6-54: What are the gear ratios on low and intermediate speeds? I can get 45 miles per hour on intermediate speed and only 55 miles per hour on high. There surely must be more difference than that in the second and high-speed gears, and if so where is the loss of power?

2—The motor misses a great deal when running about 10 or 12 miles per hour on high, but usually hits all right at a higher speed of the motor. What is the probable cause of the missing? The car is equipped with a Zenith carburetor, which has no adjustments. Could this loss of power or missing come from carburetion?

3—What is the probable trouble when the motor misses and spits at a speed of 35 or 40 miles per hour?

4—Does Motor Age consider the electric heating apparatus on the intake pipe of much aid in starting in cold weather?

5—Would an ammeter on the dash be a paying investment? If so, where could I secure a good one?

6—Would a hydrometer test the fluid of the battery accurate?—Arlo Kunkel.

THE Readers Clearing House department of Motor Age has an inquiry from A. E. Burns in which he neglected to give his address. We have the information desired and as soon as the address is received it will be forwarded to him.

1—The gear ratios of the Hudson 6-54 are as follows:

First speed.....10.25 to 1
Second speed..... 5.74 to 1

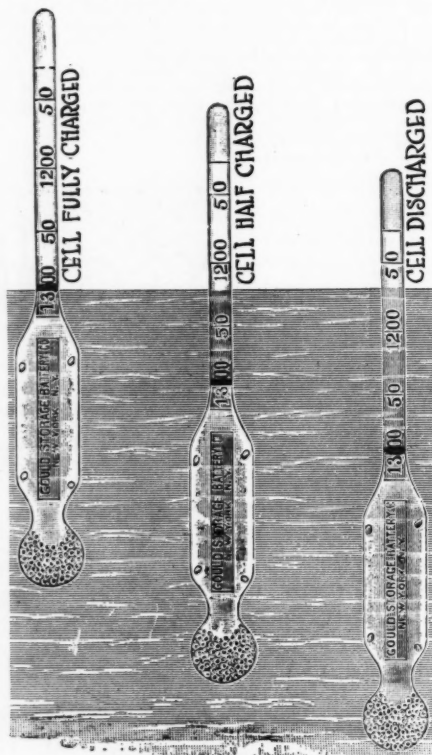


Fig. 3—Showing hydrometer readings of cells in various conditions

Third speed..... 3.75 to 1
Fourth speed..... 2.89 to 1
Reverse speed.....12.53 to 1
Possibly your engine is not tuned up very well.

2—It looks as if your carburetor were out of adjustment. Take the car to a Zenith agency and have them put in a different nozzle, unless other causes may show up to account for the missing. Better also see that the ignition system is in good shape.

3—The carburetor is not adjusted correctly for speed. Too much air in the mixture.

4—It undoubtedly is an advantage.

5—Yes, an ammeter is of value. Several are advertised in Motor Age.

6—Yes, but be sure to get one that reads accurately.

SOME VALVE TIMING INFORMATION

Reasons for Not Closing Intake and Opening Exhaust on Bottom Center

Durant, Ia.—Editor Motor Age—In Motor Age of September 24, 1914, was published the valve timing of a number of American built motors and I notice there is a big difference in the different motors. I would like the following information:

1—At what degree should the intake and exhaust open and close and get the maximum power?

2—What are the objections of opening the intake on top dead center and closing on bottom dead center?

3—What is the objection to closing the exhaust at top dead center and opening the exhaust about 30 degrees before bottom dead center?

4—How large should the valve opening be on a 3½-inch bore motor with 4-inch stroke?—Arthur Schiele.

1—That would be impossible to state arbitrarily. The valve timing depends on the design of the engine, the speed at which it operates and other conditions. What would be a good timing for any one engine might not be at all satisfactory for another.

2—If the engine is a high speed type, you can open the intake at top center, but the practice is almost universal of leaving the inlet valve open until the piston has not only reached the bottom of its stroke but has actually started back on its upward stroke again, ordinarily about ½-inch up. At first thought it would seem that some of the gas would be forced out again, but you are overlooking the speed at which the engine is running. At a normal rate of speed some fifteen complete cycles would be covered in 1 minute, and at such a speed the piston has reached the lowest point of its stroke before the gas has all been able to get in, because the gas is slower. So even when the compression stroke begins there is some suction tending to draw the gas in, providing the inlet valve is still open. You can see from this that the exact time at which the inlet valve should close depends largely upon the speed of the engine, and no one setting will work with equal advantage at all speeds. For instance, if the timing is such that the closing is late, when the engine is running very slowly the gas is practically sent back. But it is speed running that this

setting is intended for, hence the low speed disadvantage in this case is overlooked. Also if it were set to operate satisfactorily at low speed, there would be a disadvantage at high speed, for reasons already set forth.

3—As the desire is to scavenge the cylinders as thoroughly as possible the exhaust should be open for as wide a range as is practicable, and it is better to hold it for a few degrees after top center. Thirty degrees is all right for some engines, but the majority open the exhaust between 40 and 50 degrees before lower center. That is because the exhaust must open somewhat before the piston reaches the end of the combustion stroke, and the higher the speed of the engine the more desirable an early opening becomes, for reasons already outlined in connection with the flow of the gas into the intake.

4—About 1½ inch.

TOO MUCH DEMAND ON DRY CELLS Should be Used Only for Starting and Not for Continuous Running

Fort Scott, Kan.—Editor Motor Age—I have a 1914 Maxwell 40, which is hard to start; after starting it runs well. After putting in five new dry batteries it will start fairly well, but in about a week the batteries are running low and it is necessary to prime several times and refill the radiator with hot water in order to start the motor. The car is equipped with a Schebler carburetor and a model X Splittorf magneto and coil. The car runs fine after the engine is once started and will idle fairly good, but after driving 1 or 2 hours, even in warm weather I have to prime the engine to get it to start. It does not do any good to spin the motor; if it will start at all it will start on the first turn of the crank.

2—Is it wrong to couple up the dry batteries to the coil, in above equipment, that is in regard to positive and negative poles?

3—In this car is it intended to depend on the motor oiling system for its transmission lubrication?—Reader.

1—The dry batteries should be used only for starting. You probably are in the habit of letting the engine run for some time on the batteries before switching to the magneto. Just as soon as the engine has started you should switch over to the magneto in order to conserve the batteries. These dry cells soon get exhausted if they are used for continuous or closed circuit work. A dry battery is not intended for any other than open circuit work; that is, for use only at intervals. The reason the motor will not start well is evidently because the batteries are exhausted and do not give sufficient size of spark. You might get better results by using a regular sparking battery of the storage type instead of dry cells.

2—The batteries should be connected to the coil, but we do not understand your reference to positive and negative.

3—The gearset is lubricated independently of the engine.

Chalmers 6-30 Horsepower

Detroit, Mich.—Editor Motor Age—In the issue of February 17, page 35, the answer regarding speed and power of a Chalmers 6-30 are not clear to me. In answer to questions 1 and 2, Motor Age says it develops 23 horsepower at 684 r.p.m., and in No. 3 answer, 16 horsepower for 607 r.p.m., 7 horsepower difference in 77 revolutions. Kindly explain how this is calculated. Undoubtedly a stock gear ratio was taken into consideration to figure answers to ques-

tions 1, 2 and 3. On the same basis why cannot one figure what the speed and horsepower would be at 3,400 revolutions. I am much interested in this 3,400 revolution motor and would like to know the speed and horsepower.—O. E. Carroll.

That was a misprint. Thanks for calling our attention to it. The horsepower at 684 revolutions per minute is 18, and at 607 revolutions per minute it is 16. The power curve of this engine is only given to 2,400 revolutions per minute, hence we are unable to give any data on performances at 3,400 revolutions per minute. The factory might help you on this, however.

SOME MOTOR CAR TERMS DEFINED Meaning of Center of Gravity, Thermal Efficiency and Three-Point Suspension

Louisville, Ky.—Editor Motor Age—Does the Stutz company make six cylinder cars at present? If not, did it ever make them?

2—What is meant by three-point suspension of a motor?

3—What is meant by center of gravity of a motor car?

4—What is meant by thermal efficiency?

5—Is there any way to take up the wear in a full floating rear axle?—Theo. Schneider.

1—The Stutz company is marketing

fours only. No six has been built to our knowledge.

NUMEROUS inquiries are coming to Motor Age for the names of firms who supply parts for converting the regular Ford car into a roadster of the racing type. We should be glad to have the name of any one who makes a specialty of this work that we may extend our service so as to give a greater benefit to our readers.

2—Three-point suspension means exactly what the term implies, namely, that the engine is supported in the chassis at three points only. Usually there is a support at either side of the flywheel and one in the center at the front. This allows the powerplant to maintain a level position without regard to the twisting of the frame under any conditions.

3—The center of gravity of a body, whether it be a motor car or other thing, is that point about which, if suspended,

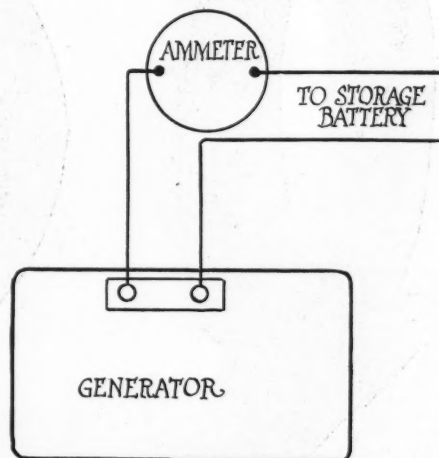


Fig. 4—Installation of an ammeter on a Studebaker

all the parts will be in equilibrium and there will be no rotative tendency.

4—Thermal efficiency is the ratio of the work actually done, when expressed in heat units, to the total heat supplied in the fuel that enters combustion chamber.

5—If by wear you mean wear of the gears, you can take this up by moving the teeth of the pinion and ring gear closer together. There are usually adjustments either side of the ring gear to allow of its being moved slightly to the right or left, and there is usually an adjustment providing for the moving of the pinion back or forward.

Engine and Car Speeds

Union City, Mich.—Editor Motor Age—How many revolutions per minute does the motor in a model T Ford make when running 10 miles per hour on high?

2—How many revolutions per minute does the motor in a 4-90 Chevrolet make when running 10 miles per hour on high?

3—What company makes the motor for the 4-90 Chevrolet?—C. B. Spore.

1—392 revolutions per minute.

2—378 revolutions per minute.

3—Chevrolet company.

What Is Meaning of Service

Charlotte, Mich.—Editor Motor Age—I would like to say a word in regard to service that seems to be such a big item among the big companies of today. Service means, as I take it, supplying your customers' needs as quickly and efficiently as possible even to your own discomfort. Now why does the car owner have to wait from a week to 2 months for parts or other services from the factory when such parts are being used every day in the manufacture of cars? Simply because the part required would further deplete the factory stock and hinder speed production? It may be well to speak of service as practiced in the larger cities, but a small town where maybe a dozen cars are sold of any particular kind, wait, wait and then when the shipment does arrive there will be a big sticker on the wrapper that says, "— means service"; service, yes, for the big sales districts or branches, but for the small town, never. I don't see that the motoring public, daily papers and motor journals should heap it up on to the garage. Why not look at the one farther up, the manufacturer.—A. L. Bennett.

Putting Ammeter on Studebaker

Waterloo, Ia.—Editor Motor Age—Could a 1914 Studebaker be run with the storage battery out, by connecting two terminals on the generator with copper wire, or must the generator be disconnected from its drive?

2—I wish to put an ammeter on the dash, showing the charge and discharge of the generator. Kindly show where to make connections.

3—How many pounds of air compression should the gauge show on each cylinder of the Studebaker 1914 model?—H. G. Mason.

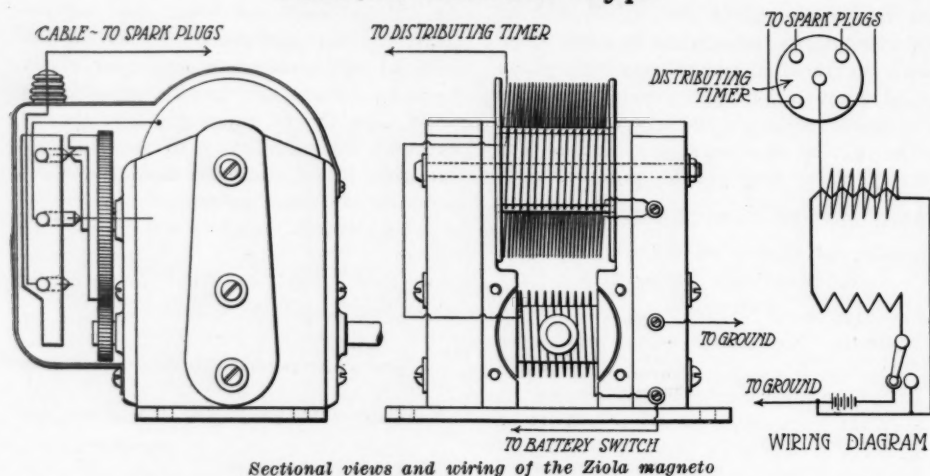
1—No. It would injure the generator to run it with any arrangement of wiring when the storage battery is disconnected. You would have to disconnect the generator drive.

2—Connect the ammeter into the line between generator and storage battery, as shown in Fig. 4.

3—About 65 pounds per square inch.

Ziola Magneto Builds Own Magnetism

Does Not Depend on Stationary Magnets — High-Tension Current Type



THE new Ziola magneto is really a high-tension generator. It has a soft laminated field throughout, and the high-tension winding, instead of being wound on the armature, is wound on a stationary side of the field on one spool, therefore increasing its insulation and making it possible to produce higher voltage without taking chances in the leakage of the current. A very small amount of current from the battery is thrown into the winding of the motor, which, while revolving, induces current in the high-voltage section. There is also a special winding in the stationary part of the field which makes the inductive action uniform through the entire stator. By revolving the armature the magnetic current is being broken and thus alternating current of enormous force is induced in the high-tension winding.

Build Up Own Magnetism

This type of a high-tension generator does not depend upon stationary magnets but builds up its own magnetism while running. It may be used on cars carrying a starter and a storage battery. Should any one desire to equip his car with this type of magneto and have it generate a spark without the use of a battery this magneto may be equipped with an addition of permanent magnets which will be charged with electric current during the entire time while the motor is running. In other words, the life of the magnetism will build up with the running of the engine and the output of the spark from the generator will not depend on the permanentness of magnetism.

Both of these types of the high-tension generator are equipped with either a stationary or movable distributor. Different motor car manufacturers carry different opinions as to the advancement and retardment of the spark. Manufacturers, who prefer to advance the spark in the secondary circuit may do so by providing a movable distributor. If it is desired,

however, to advance the spark with a make and break in the primary circuit, this may be done and the movable distributor will not be necessary.

The Ziola generator is of the closed cir-

cuit type and its magnetic leakage is low. Henry A. Ziola, Ziola Engineering Co. of America, Madison, Wis., is the patentee of the magneto.

CHICAGO VEHICLE TAX \$768,028

Chicago, Ill., March 24—A. W. Miller, superintendent of streets of the bureau of streets of Chicago, has submitted a report of the vehicle tax expenditures for 1915 in which it is shown that a steadily increasing revenue from this source is increasing the resources of the bureau for keeping streets in repair. Collections in 1915 amounted to \$768,028, which was \$37,491 more than the previous year. During the year 133 miles of various pavements were released from contractors' reserves and came under the care of the bureau, this additional mileage making a total of 1,457 miles to be maintained by the bureau. The expenditures for maintenance, together with the expenditures of the city collector and police department, were \$792,023, an average of \$543.55 per mile. When the yardage covered in repairing pavements is considered as a roadway 30 feet wide, a total distance of 450 miles was taken care of in 1915.

Unique Radiator On Mack Trucks

Semi-Circular Copper Tubes Are Used

THE radiator used on the Mack model TAC truck is new and of entirely original design. By the use of a large number of practically semi-circular sec-

tions of copper tubes, which are expanded into plates that in turn are bolted to top and bottom headers, a solderless radiator is obtained, which expands within itself



The semi-circular copper tubes that form Mack truck radiator

and withstands severe vibration without failure.

Both top and bottom headers are of aluminum alloy and the upper header forms part of the cowl, while the lower is part of the frame that supports the radiator. The tubes are expanded into the end plates and no solder is used in the construction. As each tube is a unit in itself, one or more of the tubes can be blocked or pinched off in case of emergency without interfering with the others.

Instead of being placed in front of the engine the new radiator is installed back of it, and a centrally located fan draws air from the driver's cab as well as the motor compartment, and discharges it at the sides. Thus a constant stream of cool air is passed over the radiator tubes, and, as screens are provided on each side of the hood, cool air is also drawn past the engine.

A Test Made

An illustration of the way tubes of this radiator will stand expansion and contraction without leakage is shown in the case of an "AC" truck that was left standing outdoors on a very cold day. The water in the radiator was frozen solid, and so great was the strain upon thawing that the lower section of the bottom header burst, yet the tubes remained in good condition. Replacing the broken header was an easy matter. The bolts were removed from the two plates holding the tubes, after which the header was unbolted from the chassis and a new one bolted in its place.

QUAKERS PLAN FALL RACE

Philadelphia, Pa., March 25—The first step in the direction of holding a race on the new 2-mile speedway, in course of construction at Hatboro, was taken March 15 at a meeting of the Philadelphia Motor Speedway Association. The meeting was addressed by Fred Wagner, official starter of races.

Milburn Has Electric Brougham at \$1,585

This Model Is Larger Than the Coupe or Roadster Types Which Are Continued

BESIDES continuing its model 15 chassis, and on which its model 15 coupe and model 151 roadster are mounted, the Milburn Wagon Co., Toledo, O., is offering for 1916 a new model, a brougham at \$1,585 to be known as model 22. This car was designed primarily for those who desire an electric larger than the other Milburn models.

The brougham is not unlike the coupe in appearance, but considerably larger. It measures 63½ inches from front to rear glass; its doors are 26½ inches in width and its cushions are wider and deeper than those in the other cars. The windows are raised and lowered by the Dura mechanical window lifter.

Although the new model is larger and even more luxurious than the company's former models and has a wheelbase of 105 inches, as compared with 100 inches and 32-inch wheels, as compared with 30-inch wheels on the coupe, it weighs but a few pounds more than the latter. Improvements in design and the use of finer steel have made this possible.

Simplicity is apparent in the whole construction of these cars, which have as their chief feature light weight and low cost. Among the many points which the Milburn company claims puts their product in the highest grade of electrics are the following:

Cantilever springs are used in the rear wheel which make for easier riding; General Electric motor and controller are used and the controlling and steering apparatus have all the latest improvements; spring bolts are provided with self-lubricating bushings, which obviate the necessity of turning up grease cups; the standard bat-

tery consists of 22 cells of 17 W. T. X. I. Philadelphia Diamond grid plates. For purchasers who desire even greater speed than normally provided, a larger cell equipment is offered at a small additional expense. Edison batteries also can be obtained at a reasonable extra cost.

The Milburn Wagon Co. reports that great interest already is being shown in the new model and that it is working overtime to fill the orders.

OHIO COMPANY MAKES CHASSIS

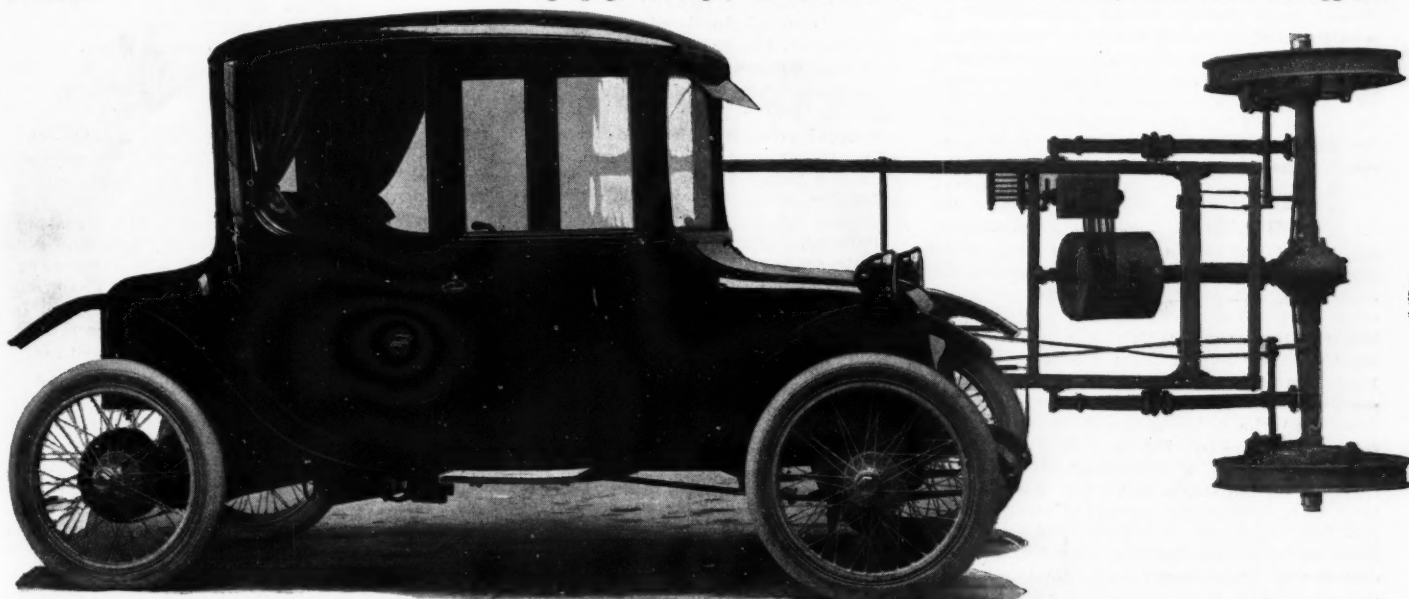
Napoleon, O., March 25—The Napoleon Auto. Mfg. Co., on April 1, will begin the production of a light 25 horsepower chassis with an immediate output of 2 or 3 daily, this to be increased in the near future. The plant has been secured and is equipped with all necessary machinery and is ready for operation.

A four-cylinder motor will be used in the new chassis, which will have selective gearset, disk clutch, two-unit starting and lighting, battery ignition, semi-floating rear axle, vacuum gasoline feed and cantilever rear springs. It is designed for cars to weigh from 2,000 to 2,200 pounds.

The company is capitalized at \$75,000 and temporary offices have been opened in the Vocke block until quarters at the plant are ready.

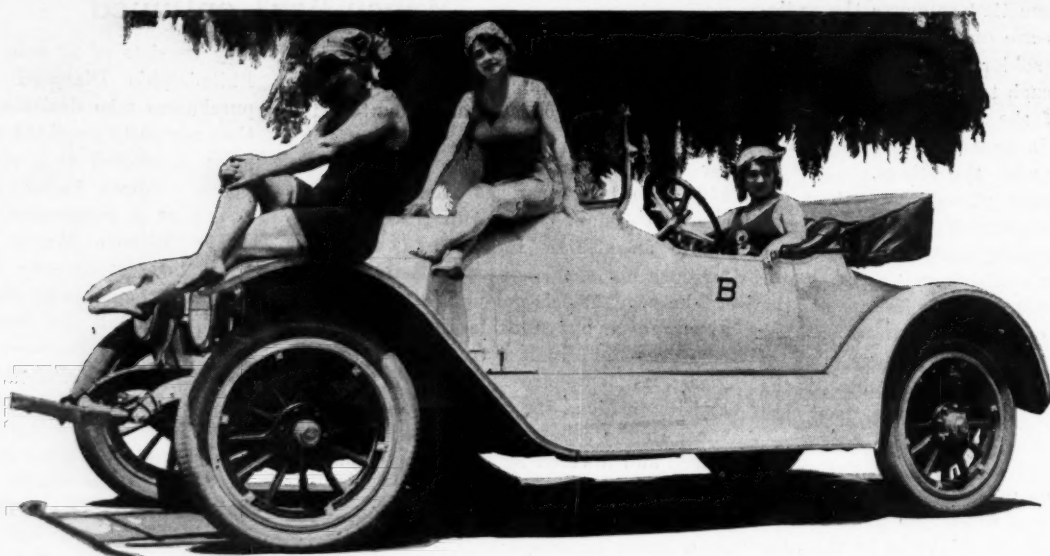
PULLEN IN MERCER AT ASCOT

Similarity of names resulted in a typographical error when Motor Age published the news of the Ascot 100-mile race of March 5, the name of Eddie Pullen's car, a Mercer being in one paragraph given as a Mercedes. Elsewhere in the article, and in the headline, the correct name appeared.



The new Milburn electric brougham and a section of the chassis

From the Four Winds



EASY PARADE PRIZE WINNER—The judges in the bathers' parade at Pasadena, Cal., had no difficulty in agreeing upon the winner of the first prize. This was awarded to the National roadster, which was decorated with three movie staresses. That the judges were biased in their decision is easy to appreciate by a glance at the accompanying photograph, but the young lady who rode the fender and the young lady who rode upon the hood paid the National a rare compliment by saying that it rode so smoothly and easily that they did not envy the third young lady, who had the upholstered seat. While this parade was not in any sense a contest of the easy riding qualities of the various cars in the procession, nevertheless the National dealer in Pasadena is cashing in as a result of the vibrationless, joltless and jarless demonstration made by these three young women. A newspaper wit recommends to the National factory that they use this as an argument to depict the coolness of the National motor.

MOTOR Cars Arrive Year Late—Because they were originally started in a German ship, a large quantity of Maxwell motor cars, sent forward to Robert J. Lewis, Australian distributor, arrived at their destination only after going through a prize court, and nearly a year late. They were doubly welcome, however, as all trans-Pacific shipments have been delayed and the country is in the throes of a motor car famine.

Precious Fluid Goes to Waste—With gasoline selling at 26 cents per gallon and prospects of its going higher, a Hartford, Conn., independent dealer experienced what he terms a case of "hard luck." A tank car of gasoline had been placed on a siding adjacent to the storage reservoir. The connection was made between the tank car and the pipe line and the fuel turned in. A break in the connection occurred and 3,000 gallons of gasoline were wasted. An effort was made with some success to get the waste into barrels. A bystander had the presence of mind to close the emergency shut-off at the top of the tank.

Fictitious License Tags—There are some motor car owners in Georgia who think all they have to do is to have a new number looking like that which the state sells, whether they buy it from the state or not. Last year a number of owners procured numbers by having private firms manufacture them in a resemblance to those sold from the office of the secretary of state. That a number of inquiries for unofficial tags have been made this year is evidenced by a letter which the secretary of state has just received from an Atlanta concern. Last year at least one Georgia motorist was indicted and prosecuted for purchasing a 1915 tag elsewhere than from the secretary of state. This probably put the concern selling it on the lookout this year. When applica-

The Show Circuit



Wheeling, Va., Show—Secretary A. H. Hoblitzell, of the Ohio Valley Automobile Club, is receiving the entries for the first motor car show of Wheeling, Va., to be held from March 27 to April 1. The Wheeling Auditorium, the largest building in the state, has been obtained for the event.

Kenosha, Wis., Show—By holding the Kenosha Motor Show during the week of the local poultry show and farmers' institute, motor car dealers agree that they gained a larger attendance and created considerably more interest in the motor car business than would have been possible otherwise. Every farmer attending the institute or poultry show had some questions to ask about motor cars.

Iowa's First Tractor Show—Business men of Cedar Rapids, Ia., have leased 400 acres of land and have obtained optional leases on 600 additional acres, where they plan to conduct a big tractor exhibit and demonstration during the third week in August. This will be the first tractor demonstration on a large scale ever held in Iowa, and it is expected that farmers and dealers from all over Iowa, southern Minnesota and northern and western Illinois will attend. The exhibition of 100 tractors has been planned. There will also be held a demonstration of power road-making machinery, which will bring the supervisors from every county in the state.

tions began to come in this firm wrote the secretary of state and asked him whether it would be a violation of the law to supply these tags.

Suggest Licenses for Trailers—A proposition to license and regulate trailers used in connection with motor vehicles is being considered in Milwaukee as the result of the discussion held by the Milwaukee Executives' Association, composed of the heads of leading business houses. The trailer presents a new problem by its wide use. It is likely that the Milwaukee common council will adopt an ordinance to license trailers just as motor vehicles are licensed, as is done in other large cities. When the Wisconsin legislature meets again, in January, 1917, a state-wide licensing law for trailers will be presented.

Wisconsin Law Exonerates Owner—The attorney general of Wisconsin, in an opinion handed down lately, holds that only the driver, and not the owner, should be seated in the motor vehicle, is responsible when the law is violated. Richland county officials brought up the point and were instructed to prosecute only the chauffeur in a case where the car was not stopped for a frightened horse, as required by law. The owner of the car was in it at the time.

Trapping Motor Car Thieves—A new plan to make it harder for motor car thieves to get out of Colorado with stolen cars will be tried out this year by Secretary of State Ramer and Chief Motor License Inspector De Lochte. Sheriffs of border counties in all states adjoining Colorado will be requested to stop cars carrying Colorado license tags and ask to see the owner's registration certificate. If this cannot be produced, the sheriff will inquire concerning the exact residence of the party claiming to own the car, and then check up with his record of

the series of license number blocks as allotted to the individual Colorado counties. If suspicion justifies, he will then hold the car until he can communicate with the proper authorities to determine the identity of the machine and its owner.

Garage Man Charged with Manslaughter—S. W. Renner, a garage owner of Columbus, O., has been indicted by the grand jury on the charge of manslaughter for the killing of B. J. Arnold, January 8. A police officer was in the car driven by Renner, when the accident occurred. Mr. Renner pleaded not guilty.

Regulate Parking of Cars—In orders to regulate the parking of motor cars and to prevent congestion of traffic on downtown streets traffic signs have been erected along the curbs of Davenport, Ia., streets. The city council decided that signs would be better than the enactment of an ordinance providing for parking at specified places. The signs will warn the motorist not to park his car within 20 feet of any fire hydrant and that a space of 4 feet must be left between cars.

Good Roads Activities

Million for Roads in This County—Delaware county, Ind., will spend approximately \$1,000,000 during 1916 in the construction of new roads and the improvement of old ones, according to estimates prepared today by County Surveyor S. Horace Weber. If all the road petitions now before the county commissioners are approved, a total of forty-eight roads will be constructed or improved.

Conference to Select Northwest Route—The convention called to decide upon the route of the Lewis and Clarke highway from Savannah to Seattle will be held in Omaha, Neb., April 24 and 25. An organization to back the highway's promotion will be perfected. Two delegates will be received from each of the principal cities invited to send delegations. The route as now planned runs through the states of Georgia, Alabama, Tennessee, Missouri, Kansas, Nebraska, Iowa, South Dakota, Wyoming, Montana, Idaho and Washington. It is expected to have the entire highway marked for travel during the coming season.

Midland Trail Boosters Active—A nationwide campaign, originating in Colorado, has been started by the National Midland Trail Association to build up this scenic transcontinental highway across the Rockies. Lincoln Antles, Grand Junction, Colo., secretary-treasurer of the association, has just organized a local branch in Denver, and started on a tour east as far as Washington to organize locals and otherwise gain support all along the route. He has already covered the Utah link of the road, both for organizing and for logging the route, and plans to put out an edition of 10,000 log books covering the entire trail.

Good Roads Educational Special—The Iowa good roads special train completed a 7-days' tour of the state, March 27. The special carried an exhibit car containing models of all kinds of good roads machinery and typical good roads. Governor Clarke accompanied the train during part of its schedule. Speaking talent was furnished by the good roads division of the federal government. More than 200,000 persons live in the cities and towns visited by the special, which left Des Moines, the capital, March 20 for the trip. Twenty-eight cities and towns were visited and a distance of 699 miles was covered.

Construct Chicago-St. Louis Highway—Subscribers to the Chicago-St. Louis Automobile Boulevard Corp., which proposes to construct a concrete toll road between the two metropolitan cities running via Kanka-

kee, Decatur, Bloomington and Alton, have been asked to pay their first assessment, indicating that work will commence this spring. In sending out the notices calling for the preliminary assessments the promoters state that it is desired to secure the right of way, remove all of the fences and other obstructions and commence the grading. It is promised that the funds will be expended economically and the hope is expressed that in due time to "give Illinois one of America's greatest commercial enterprises."

Minnesota Spends \$7,500,000 on Roads—More than 3,000 miles of roads in Minnesota are to be improved in 1916 at a cost of \$7,453,451. More than 1,000 miles are to be graveled and 2,000 miles graded. The state apportionment of taxes, including motor car registration, is \$500,000. The county road and bridge taxes added \$2,753,451 and the townships \$3,200,000.

Central Nebraska Highway Popular—The statewide movement of the Omaha Automobile Club for better-marked Nebraska highways has brought out the fact that the Lincoln highway has a strong contender for overland tourist traffic over some 200 miles of Nebraska territory. This stretch lies between Columbus, Neb., and North Platte, Neb., and it is acknowledged that the Central Nebraska highway is about 65 miles shorter than the national highway between these two points. The fact that the central route is a high-line road, leading through a varied section of the state, is also considered quite an argument, as it gives the tourist an opportunity to gain a more diversified view of the country and its people than the river road, which follows a wide, flat valley for most of this distance.

Texas Meeting Well Attended—More than three hundred delegates attended the annual convention of the Texas Good Roads Association which was held at Taylor, Texas, March 16 and 17. It was the largest and

most enthusiastic gathering of exponents of improved highways ever held in the state. The discussion covered a wide range of subjects, all having more or less bearing on the betterment and extension of the good roads systems of Texas.

Military Road Across Continent—At the second annual meeting of the Illinois division of the Pike's Peak, Ocean-to-Ocean Highway Association, held last week in Springfield, Ill., officers for the ensuing year were elected as follows: Pres., G. W. Hughes, Hume, Ill.; Vice-pres., F. A. D. Stone, Griggsville, Ill.; Secretary-treasurer, H. A. Scheidker, Hannibal, Mo. A resolution was adopted calling upon Senator Sherman to offer a bill to have the highway declared a military road. It is 3,533 miles in length and extends through the capitals of eight states. It was voted to raise \$1,500 for the improvement of the highway through Illinois. The marking from Indianapolis, Ind., to Salt Lake City, Utah, was completed last year. This year the marking will be made between Indianapolis and Pittsburgh, Pa. Gov. Edward F. Dunne, of Illinois, addressed the meeting.

With the Motor Clubs

Ft. Madison, Ia., Motorists Organize—Motor car owners of Ft. Madison, Ia., met last week to form a motor club. The club will support a campaign for permanent hard-surfaced roads between Ft. Madison and adjoining cities. It will also mark these roads and blaze new trails.

Scranton, Pa., Wants Organization—Efforts are being made to reorganize the Scranton Automobile Club, at Scranton, Pa. The organization has practically gone out of existence so far as active membership is concerned. It is expected that before the summer months at least 600 motorists will have banded together.

New Club at Springfield, Ill.—Motorists at Springfield, Ill., last week organized the Springfield Motor Club. The officers chosen for 1916 are C. J. Root, president; Harry Nickey, vice-president; Ray Stout, secretary; E. L. Keys, treasurer. A constitution and by-laws were adopted declaring the object of the club to promote permanent good roads and support legislation in the interest of improved highways. It was decided to affiliate with the A. A. A.

"1,500,000 Bond Issue Club"—Members of the Aurora Automobile Club, Aurora, Ill., have endorsed a proposed bond issue of \$1,500,000, to be used in constructing and improving roads in Kane county, which is one of the counties of densest population in Illinois. The "1,500,000 Bond Issue Club" has been organized and an active campaign begun in other towns of Kane county, with the idea of submitting the proposition to a vote of the people in the sixteen townships in the county. The adoption of the plan would be followed by similar bond issues in other counties of Illinois, say Aurora motorists.

Campaign to Defeat Ordinance—A campaign has been started by the Automobile Trades Association of Colorado to defeat a proposed special tax of \$25 a year on garages and motor car salesrooms in Denver, Colo. The new measure is intended to take the place of a similar but confusing ordinance passed by the city council a few months ago, which the trades body has succeeded in getting repealed. That law was originally drawn for a \$50 license, but after the fee was reduced to \$25 the trades association withdrew its opposition and the measure was passed. Then it was discovered that the wording was such that even the city officials were unable to agree concerning its exact interpretation. Garages doing a big storage business took advantage of the confusion and managed to dodge the fee simply by not selling gasoline or oils or current for power.

Coming Motor Events

SHOWS

March 28-31—Saginaw, Mich., show.
April 1-8—Butte, Mont., show.
April 10-15—Seattle, Wash., show.
April 12-15—Calumet, Mich., show.

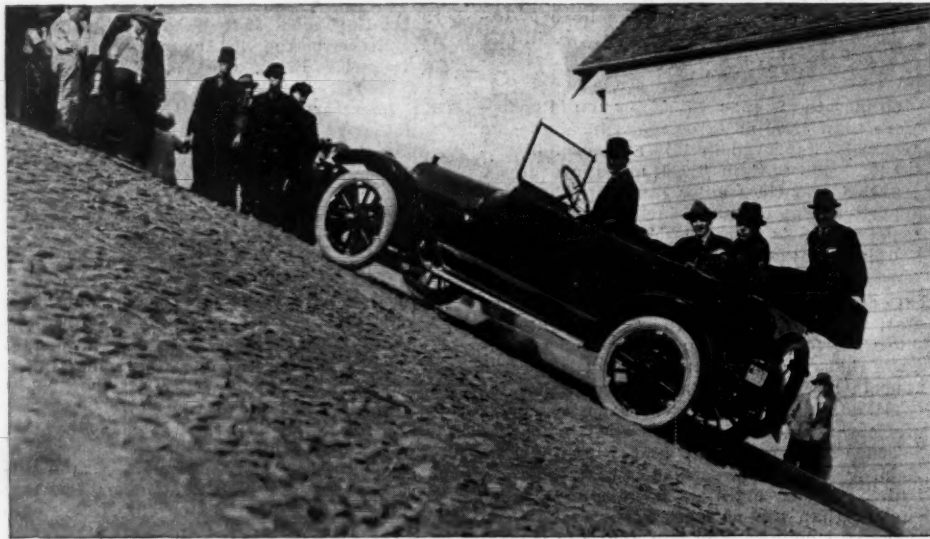
CONTESTS

April 8—Corona, Cal., boulevard race.
May 6—Sioux City, Ia., Speedway race.
May 13—New York, Sheephead Bay speedway race.
*May 20—Chicago speedway amateur's race.
*May 30—Indianapolis speedway race.
May 30—Tacoma, Wash., speedway race.
May 30—Minneapolis, Minn., speedway race.
*June 10—Chicago speedway race.
June 28—Des Moines, Ia., speedway race.
July 4—Minneapolis speedway race.
July 4—Sioux City speedway race.
July 4—Track meet, Coeur d'Alene, Ida.
July 15—Omaha, Neb., speedway race.
July 15—Track meet, North Yakima, Wash.
August 11-12—Hillclimb, Pike's Peak, Colo.
August 5—Tacoma speedway race.
August 18-19—Elgin road race.
September 4—Indianapolis speedway race.
September 4—Des Moines, Ia., speedway race.
September 4-5—Track meet, Spokane, Wash.
September 16—Speedway race, Providence, R. I.
September 29—Track meet, Trenton, N. J.
September 30—New York, Sheephead Bay speedway race.
October 7—Omaha speedway race.
October 14—Chicago speedway race.
October 19—Indianapolis speedway race.

* Sanctioned by A. A. A.



Among the Makers and Dealers



KISSELKAR CLIMBS STEEP GRADE—The above illustration shows a KesselKar 32, with four men aboard, climbing Duncan street hill in San Francisco, Cal. It stopped in the middle of the hill to show brake action and then completed the ascent. This hill is said to be a terror. In order to take the last pitch a car has practically to climb the side of a wall. Time after time cars have attempted the grade, only to lose their traction. What makes the hill unusually difficult is the fact that it is impossible for the driver to get a run for the steepest part. There are two blocks of steady climbing before reaching the heaviest grade.

300,000 Carter Detectors per Year—The Carter Spark Plug Detector Co., Detroit, Mich., is equipping a new plant which will have a capacity of 300,000 Carter Detectors a year.

E. E. Shupe in Lozier Employ—The H. A. Lozier Co., Cleveland, O., has appointed E. E. Shupe as its advertising manager. He was for 3 years manager of the Cleveland Cyclone Fence Co. sales promotion department.

R. H. Crooker Joins Chalmers—Robert H. Crooker, who was advertising manager for the Regal Motor Car Co., has been appointed assistant advertising manager of the Chalmers Motor Co.

Chalmers Opens Dallas, Tex., Depot—The Chalmers Motor Co. has opened a wholesale distributing depot in Dallas, Tex., under the firm name of the Chalmers Motor Sales Co. W. W. Morris, Jr., is the manager.

King Co. Transfers I. B. Meers—I. B. Meers, assistant sales manager of the King Motor Car Co., Detroit, Mich., is now in charge of the Pacific Coast business of the King company with headquarters in San Francisco, Cal.

E. E. Caister Handles Marmon—E. E. Caister has become sales manager for Al. G. Faulkner Co., Inc., southern California distributors for Marmon cars. Mr. Caister was for nine years sales manager for the Earl C. Anthony Co. of Los Angeles.

Maxwell Builds at Dayton, O.—The Maxwell Motor Co. will build an addition to its foundry building at plant No. 2 in Dayton, O., to cost between \$100,000 and \$125,000. Bids for the erection and equipment of the addition are being received at the Detroit headquarters of the company.

Factory Holds "Drive-Away" Day—Dealers from many states were here last week to participate in the drive-away of the Inter-State Automobile Co., Muncie, Ind. The Inter-State officials were the first to institute the drive-away idea and it has been copied by other motor car manufacturers.

Dealers drove 150 Inter-State machines away from the factory.

Studebaker Leases Foundry—The Studebaker Corp. has leased the foundry building of the U. S. Radiator Corp., at Detroit, to be used for storage purposes. The building has 30,000 square feet of floor space.

Chevrolet Appoints Sales Manager—S. K. Lane, for some time manager for the Chevrolet Motor Car Co. in Dallas, Texas, has been made sales manager for the company and will move to Flint, Mich.

Maxwell Selects Ontario Location—By a vote of 342 to 290 in the council of Windsor, Ont., the by-law to give tax exemption to the Maxwell Motor Co., Detroit, Mich., in exchange for the erection of a \$65,000 factory in the municipally-owned industrial district, was carried last Saturday.

Motorists' Department Store—A motor car and accessories department store is to be erected at Peoria, Ill. The Cadillac Service Co. will construct a 3-story building for this purpose at a cost of \$100,000. Everything pertaining to a motor car will be found in this building.

Sellings Its Cars Through Newspapers—The Tryon Motor Sales Co., Chevrolet agent at El Paso, Texas., is trying a new experiment in selling. It has withdrawn all its outside men and will hereafter rely entirely on newspaper advertising to bring the Chevrolet to the attention of prospects. An attractive floor display has been arranged and motorists are invited to call.

Agent Sought by Creditors—P. J. Wood, who came to Davenport, Ia., one year ago, claiming to be the agent for the Cole Motor Co., and who occupied luxurious quarters at the Blackhawk hotel, is being sought by creditors. The Muscatine Car Co., has filed suit to recover two cars sold by Wood for which settlement has not been made. The hotel seized the personal effects of Wood to satisfy a claim of \$112. Employees are also

seeking unpaid salaries. His liabilities are estimated at \$2,500.

Tests New Farm Tractor—The Ohio Manufacturing Co., Upper Sandusky, O., is testing out a new farm tractor at its plant. The tractor is designed to produce great efficiency at a low cost. It is expected that the tractor will be placed on the market in the near future.

B. H. Bayless Goes to Champion—B. H. Bayless, formerly in charge of the advertising department of Berdan & Co., Toledo, O., has joined the advertising department of the Champion Spark Plug Co., Toledo, where he will assist H. L. Corey, advertising manager.

Premier Secures F. P. Nehrbas—F. P. Nehrbas has lately connected himself with the Premier Motor Corp., Indianapolis, Ind., as Factory Production Manager. Mr. Nehrbas has had over fifteen years experience in the production of automobiles and their component parts and the Premier is to be congratulated.

Willard Men Move Up—The affairs of the Willard Storage Battery Co. in the Detroit territory will hereafter be in charge of S. S. Jenkins as district manager, who has been manager of the Willard branch at Indianapolis, Ind., since it was established. F. G. Tobin, for 2 years, has been connected with the Willard branch in Detroit, Mich.

Re-Organizing Ann Arbor, Mich., Firm—It is likely that within a few days the Ann Arbor Buggy Co., Ann Arbor, Mich., will be re-organized to be devoted to making motor car trailers. The plan of those interested is to capitalize the company at \$30,000, of which \$20,000 will constitute the value of the plant and its other assets, which will leave \$10,000 for further use.

Indian Wants American Cars—Alfred Maw & Co., Winnipeg, Man., has received a letter from Madras, India, asking for quotations on the stock cars which they are agents for in this city. The India firm states that the demand for American and Canadian-made cars in that country is great. Because of the war it is difficult to procure British cars. The letter was mailed January 21. Mr. Maw received it March 4.

Promotion by Timken-Brown Co.—A number of promotions have taken place at the Timken-David Brown Co., Detroit, Mich., which makes worm-drive axles. C. T. Myers, engineer, is now manager of the company; E. T. Zollinger, is assistant manager in charge of purchases, sales, receiving, shipping and accounts; M. Taylor is now assistant engineer; C. S. Dahlquist becomes general superintendent in charge of manufacturing; M. Voelk is promoted to the position of general foreman.

Advertising Campaign for R. & M. Products—The business of the Superior Auto Parts Co., Indianapolis, Ind., sole distributor of R. & M. conform piston rings, has been taken over by the Modern Electric & Machine Co., of Indianapolis. This change is the out-growth of the increased demand for the R. & M. Conform Piston Rings and necessitated the close co-operation of the manufacturing and sales department. In the last year the Modern Electric & Machine Co., manufacturers of this ring, has added to its line the R. & M. maluminum piston and has enlarged its plant. The company, of which T. A. Meyer is president and general manager, L. H. Knue, secretary and treasurer, and H. W. Ransdall, vice-presi-

dent and experimental engineer, is planning a national advertising campaign and organizing an aggressive selling force, and also establishing sales branches.

J. B. Maus with Fisk Co.—John B. Maus, who for the last two years has been eastern district manager of the Batavia Rubber Co., Batavia, N. Y., has joined the Fisk Rubber Co. of N. Y.

Radiator Company in M. & A. M.—At a meeting of the executive committee of the Motor and Accessory Manufacturers, held in New York City, March 10th, the Rome-Turney Radiator Co. was admitted to membership.

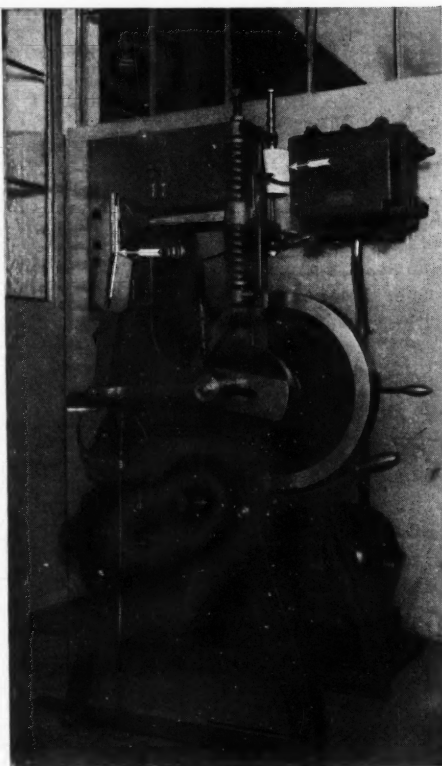
N. Y. Packard Buys Site—The Packard Motor Car Co. of New York has purchased a site in Hartford, Conn., at the corner of Park and Washington streets, and will erect on it a sales and service building in a select residential district.

Receiver for Rubber Company—The Toledo-Findlay Rubber Co., capitalized at \$300,000, has been placed in the hands of a receiver. The company was organized 15 months ago. Four of the directors made the petition for a receiver, charging that mismanagement has prevented the company from doing a profitable business.

New Company at Milwaukee—The Pioneer Mfg. Co., West Allis, Wis., has been organized by H. E. Wellbourne and established a machine shop, factory and garage. A specialty will be made of self-starting mechanisms for motor cars and cycles. O. E. Birkekab, L. K. Anderson and D. L. Christiansen are associated with Mr. Wellbourne in the enterprise.

A. P. Warner Building Trailers—The Werner Auto Trailer Co., Beloit, Wis., organized several months ago by A. P. Warner of speedometer fame, has leased the former plant of the John Thompson Sons Mfg. Co. at Beloit, and will begin a large production of the Warner trailer. The Thompson plant was used for the manufacture of gas engines and agricultural machinery, but has been idle for two years or more.

Enlarging Accessories Factories—An evidence of the increasing business of the parts and accessories makers is found in the pending construction activities of many of these concerns at Detroit, Mich. Chosen at random from among the firms mentioned by contractors in their weekly lists of contracts received, either for additions to plants or for new buildings, are six which will expend more than \$500,000 in enlarging their premises. This will mean that at least 800 to 1,000 more men will be added



FATIGUE TESTING MACHINE—One great cause of breakage in motor cars is due to the so-called fatigue of the metal brought about by alternate stress or a tendency to bend or twist the material in one direction and then in the opposite. It is of the utmost importance that the resistance of the metal to this breaking down or fatigue be known. For this purpose the Dodge Bros. laboratory uses the rather little known Upton-Lewis fatigue testing machine for the accurate determination of fatigue. The jaws shown in the illustration securely clamp the specimen. The upper jaw swings on a hinge pin and is fastened to the lower jaw through the clamped test piece. The lower jaw carries an arm which is moved back and forth by a connecting rod fastened to a crank pin. The upper jaw carries an arm held at its far end between two springs. It is the magnified action of these two springs, recorded by pencil on a revolving drum, which gives a mechanical record for the individual piece. To guard further against errors of observation, a counter supplies the actual number of vibrations received until fracture occurs.

to the working forces of these plants. The six companies are the National Can Co., the General Aluminum Brass Co., the Timken-Detroit Axle Co., the Roberts Brass Mfg. Co., the American Auto Trimming Co., and the Detroit Auto Specialty Co.

Detroit Axle Co. Prospers—The Detroit Axle Co., Detroit, Mich., has increased its capital stock from \$50,000 to \$150,000. The company started a few years ago on a small scale and its business has been steadily growing. It has a large number of orders on the books and will extend its manufacturing facilities.

R. T. Walsh with Briscoe—The Briscoe Motor Corp., Jackson, Mich., has appointed Robert T. Walsh as its advertising manager. Mr. Walsh recently resigned as advertising manager of the Maxwell Motor Co., with which he had been connected for several years. His previous connection was with the Ford Motor Co., where he was assistant advertising manager.

Denver Federal Rubber Discontinues—The Federal Rubber Mfg. Co. has discontinued its Denver, Colo., branch, and arrangements have been completed with the Federal Rubber Tire Works Co., a Denver concern, to act as Federal distributor for Colorado and adjacent territory. The president of the new distributing firm is E. R. Cumbe, for several years manager of the factory branch there, and the secretary is J. W. Billow, also well known in trade circles in this district.

New Truck Is "Wisconsin"—The Myers Machine Co., Sheboygan, Wis., which took over the Wisconsin Motor Truck Co., Baraboo, Wis., early this year, is now making deliveries of its first products. A large addition which will be devoted to the motor-truck works will make it possible to attain a considerable production, but the company is hampered by the difficulty in getting materials. The Myers company is operating 24 hours per day. The trucks are known as the "Wisconsin."

R. C. H. Producing Repair Parts—Having temporarily discontinued the manufacture of motor cars, the R. C. H. Corp. will devote its attention to the continuation of the repair parts business for R. C. H. cars. The company has recently secured new quarters at 31-33 Woodbridge street, East Detroit, Mich., and has moved its entire stock of parts, jigs, tools, dyes, patterns, etc. to this location. The personnel and management of the company remains the same, Charles P. Sieder, as president and general manager, and Theodore F. Drews, assistant general manager.

Albany, N. Y.—Sun Distributing Co.; to manufacture motor trucks, appliances, etc.; capital stock, \$500; incorporators, Herman Magnusen, A. F. Johnson, G. E. Benson.

Albany, N. Y.—Buffalo General Electric Garage; capital stock, \$10,000; incorporators, C. R. Stearns, Jr., C. Baldy, E. H. Letchworth.

Albany, N. Y.—Auto Direction Signal Co.; direction signals, accessories, etc.; capital stock, \$10,000; incorporators, J. M. Fiero, Jr., G. B. Shiras, E. A. Walz.

Albany, N. Y.—Eureka Garage Corp.; to manufacture motor cars and accessories; capital stock, \$6,000; incorporators, J. P. McCann, T. A. Cooke, Sr., T. A. Cooke, Jr.

Albany, N. Y.—Alper Auto Painting & Trimming Co.; paint and upholstery, all kinds of motor car bodies, etc.; capital stock, \$2,000; incorporators, Morris Alper, Gussie Alper, L. Kohn.

Albany, N. Y.—Chalmers Sales Corp.; to manufacture motor car supplies, parts and accessories, etc.; capital stock, \$10,000; incorporators, E. P. Chalfant, E. K. Leech, A. L. Soulesley.

Albany, N. Y.—Foster-Ketchum Auto Co.; capital stock, \$10,000; incorporators, Fred Foster, George S. Ketchum, William C. Feathers.

Buffalo, N. Y.—Debby-Buffalo Sales Corp.; motor cars, trucks, motor vehicles; capital stock, \$7,000; incorporators, M. C. Schaus, J. P. Schaus, G. F. Menolf.

Buffalo, N. Y.—Upright Tire & Rubber Co.; capital stock, \$1,000; incorporators, Sydney Bernheim, Catherine Weldon, H. W. Jacobson and W. Lissberger.

Boston, Mass.—Leary Muffler Co.; capital stock, \$100,000.

Recent Incorporations

Davenport, Ia.—Central Auto & Tire Co.; incorporators, T. L. Kennedy, E. B. Kennedy, Otto R. Arnold and C. L. Cockfield.

DePue, Wis.—Toonen-Barlament-Wright Co.; capital stock, \$10,000; incorporators, Henry Toonen, Henry Barlament and C. M. Wright.

Detroit, Mich.—Castaluminum Body Co.; capital stock, \$100,000; to make aluminum motor car bodies; incorporators, Robert F. Dyer, W. A. Watts, Charles B. Bohn.

Detroit, Mich.—Decker Auto Top Co.; capital stock, \$15,000; to make tops and do a general trimming and painting business; incorporators, W. J. Decker, I. O. Decker and P. A. Gormican.

Detroit, Mich.—Detroit Welding & Mfg. Co.; capital stock, \$10,000; incorporators, F. E. Fisher, F. E. Shaller and L. E. Smith.

Detroit, Mich.—Union Supply Co.; to manufacture starters for Ford cars; capital stock, \$10,000; incorporators, Albert E. Duncan, H. G. Longfield and Alice Longfield.

Dubuque, Ia.—Star Taxi Co.; capital stock,

\$10,000; incorporators, D. D. Meyers and J. J. Jungwirth.

Dover, Del.—Inner Spring Tube Tire Co.; capital stock, \$100,000; incorporators, R. E. McCoy, C. L. Subert, W. A. McCoy.

East Chester, N. Y.—Fregus Motors of America; to manufacture and deal in engines, motors, machinery, etc.; capital stock, \$1,000,000; incorporators, T. B. Romes, C. Beaugdy, Jr., C. T. Quantrell.

Evansville, Ind.—Calumet Auto Co.; capital stock, \$20,000; incorporators, H. F. Patberg, A. N. Schmitt, F. J. Berendes.

Jacksonville, Fla.—Florida Motors Corp.; to manufacture motor cars, motors and accessories; capital stock, \$6,000; incorporators, R. H. Shackelford, C. E. Belote.

Jacksonville, Fla.—Florida Motors Corp.; capital stock, \$6,000; incorporators, R. H. Shackelford, C. E. Belote.

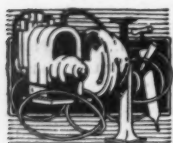
Kenosha, Wis.—Hill Garage; capital stock, \$4,000; incorporators, M. E. Hill, Peter Rohde and Louis Rohde.

Louisville, Ky.—Southern Fire Apparatus Co.; capital stock, \$33,000; to manufacture motor fire engines, fire trucks, etc.; incorporators, A. B. Young, J. M. Hoffman and E. R. Jennings.

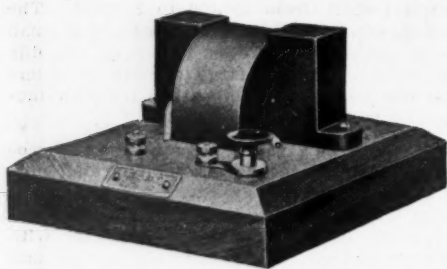
Milwaukee, Wis.—Crary Tool Co.; to manufacture tools; capital stock, \$30,000; incorporators, H. J. Trost, T. F. Hayden and B. Beebe.

Milwaukee, Wis.—Paramount Auto Exchange; to deal in new and used cars, accessories, etc.; capital stock, \$15,000; incorporators, Harry Kohn, I. Epstein and A. L. Epstein.

Newark, N. J.—Hubers-Becker Garage & Machine Co.; conduct garages, general motor car business; capital stock, \$30,000.



The Accessory Corner



The Teco magneto magnet charger

Curtis Trailer and Hitch

The improved type of Curtis trailer with the patented Curtis hitch is being made in four models. Changes have been made in the design which produce a more durable, easy-riding equipment. The Curtis hitch is intended to insure the trailer following in perfect alignment under all conditions. For Ford cars a special axle hitch is built. A spring hitch is provided for all other cars. The frame is constructed of angle iron, 2 by 2 by $\frac{3}{8}$ inches. It is equipped with cross springs. The axle is of the underslung type. Several types of bodies are built for special purposes. Model A is fitted with 34-inch wagon wheels with steel tires, and sells at \$47.60; model B, with 32 by $1\frac{1}{4}$ solid rubber tires, \$65; model C, with artillery wheels, 30 by 3 pneumatic tires and fenders, \$90; model D, ball-bearing, same as C, at \$100; model C special boat trailer, with artillery wheels, 30 by 3 pneumatic smooth tread tires and fenders, \$47.50. The manufacturer is the Curtis Trailer Co., Minneapolis, Minn. A description of the earlier Curtis models was published in Motor Age, March 11, 1915.

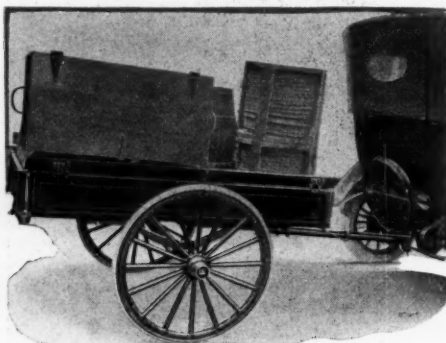
The George Delker Trailer

A trailer having side springs, with a capacity of 1,000, is built by the George Delker Co., Henderson, Ky. The firm was established in 1863 and has been in the business of manufacturing carriages. The new product is being produced to supply a need for motor car trailers in agricultural districts. A special hitch is made for Ford cars. The trailers are fitted with Timken roller bearings. The body of the standard model is 44 inches by 72 inches and 8 inches deep, and has heavy hardwood sills, 5-inch flare boards and drop end-gate. The wheels are of select hickory, with $1\frac{1}{4}$ solid rubber tires. It weighs 375 pounds, crated for shipping.

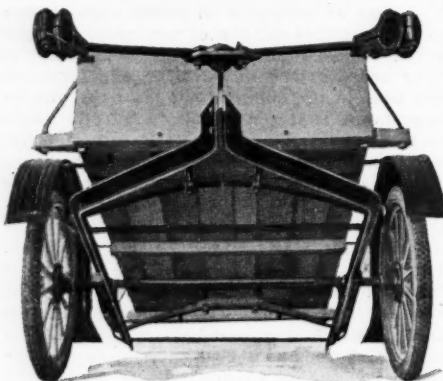
Boss Circuit Tester

With a brass circuit tester, a repair man can quickly locate broken circuits and other electrical troubles about a motor car. To find out where a wire ought to connect, the cord of the tester is attached to the supposed terminal and the switch turned on. A headpiece is provided and whenever the circuit is completed a click-

ing sound is heard. The device carries a meter and will not burn out if a heavy current is applied. The outfit weighs 3 pounds, has a polished hard rubber body 6 inches long and $2\frac{1}{2}$ inches in diameter, with a plug which may be screwed into any 110 volt direct or alternating circuit. The tester hangs up and it is necessary



The George Delker trailer



Curtis trailer and hitch

only to move the cords and the terminal connectors. It is made by the Maroa Mfg. Co., Maroa, Ill., and sells for \$15.

Teco Magnetizer

With the Teco magnetizer or magnet charger it is said to be possible to overcome ignition trouble caused by the magneto producing a weak spark. It is a product of the Tritt Electric Co., Union City, Ind. By re-magnetizing the magnets of the magneto occasionally a higher efficiency may be maintained and this is the purpose of the Teco magnetizer. It is designed to operate from an ordinary 6-volt storage battery or five or six ordinary cells. With a fully charged 6-volt 60-ampere battery, seventy-five to 100 magnetos can be re-magnetized. There are no moving parts. It lists at \$10.

Artistic Radiator Caps

It is possible for a motor car owner to ornament the radiator of his machine with his lodge emblem. Or, he may prefer a doctor's cross in finish of red or green enamel, and others will like an "America

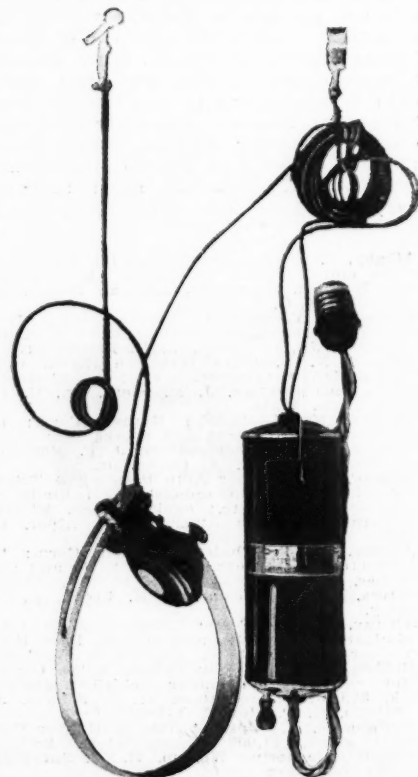
First" or a "Safety First" emblem. Radiator caps bearing the lodge emblems of every large fraternal order are manufactured by the Art Metal Works, Newark, N. J. Of course Charlie Chaplin is in the specialties list.

Clear-O-Scope

The Clear-O-Scope Co., 738 West Madison street, Chicago, is making a cleaner to remove rain and snow from the windshield, and marketing it under the name of Clear-O-Scope. It consists of a rubber-faced bar, one end of which hooks over the top of the windshield and the cleaning is done by sliding the bar back and forth. One operation cleans the glass and dries it. It may be put on or taken off of the windshield instantly. It is held by a spring which eliminates rattle. It is sold at \$1 under a money-back guarantee.

Safety Vulcanizer

The Safety Vulcanizer is a six-piece device, consisting of an adjustable clamp with thumb screw. It is manufactured by the Safety Vulcanizing Co., Mason City, Ia. After the patch has been placed in position and the clamp fastened over it, the application of a match completes the process. Only the portion of the tube upon which the patch rests can be affected by the heat-producing insert which is placed next to the patch. An outfit that includes 1 dozen patches costs \$1.50. Extra patches cost 60 cents per dozen, or 5 cents each.



The Boss circuit tester